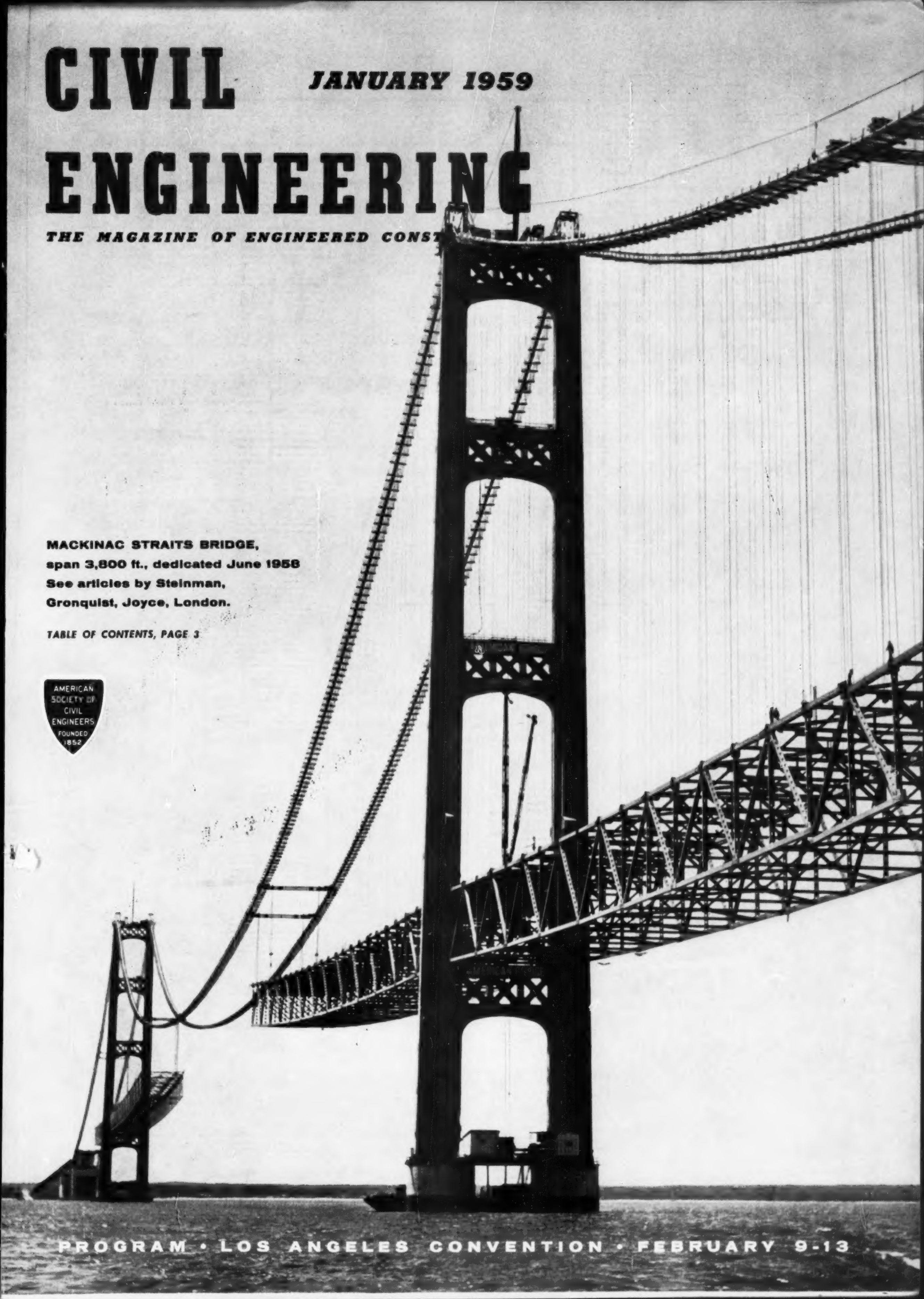
CIVIL ENGINEERING

JANUARY 1959

THE MAGAZINE OF ENGINEERED CONST



MACKINAC STRAITS BRIDGE,
span 3,800 ft., dedicated June 1958
See articles by Steinman,
Gronquist, Joyce, London.

TABLE OF CONTENTS, PAGE 3

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

PROGRAM • LOS ANGELES CONVENTION • FEBRUARY 9-13

Civil Engineering, January 1959. Vol. 29, No. 1 • Published monthly by the American Society of Civil Engineers. Publication office Concord, New Hampshire. (Second-class mail privileges authorized at Concord, New Hampshire.)

EDITORIAL & ADVERTISING DEPARTMENTS at ASCE Headquarters, 33 West 39th Street, New York 18, N.Y.

Advertising Representatives *are listed on Index to Advertisers page*

Subscription Rates—Price 50 cents a copy. $5.00 a year in advance; $4.00 a year to members and to libraries; and $2.50 a year to members of Student Chapters. Canadian postage 75 cents, and postage to all other countries outside of the United States and possessions, $1.50 additional.

Member Audit Bureau of Circulation

48,900 copies of this issue printed

CIVIL ENGINEERING

JANUARY 1959
VOL. 29 • NO. 1

THE MAGAZINE OF ENGINEERED CONSTRUCTION

• ARTICLES

• SOCIETY NEWS

• NEWS BRIEFS

• DEPARTMENTS

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

...er Repair, Prichard, Alabama

MORETRENCH WELLPOINTS CAN MAKE YOUR WET JOB LOOK LIKE THIS . . .

HERE'S HOW:

1. An experienced engineer studies your project, estimates the amount of wellpoint equipment needed to predrain it *properly*, plans the system to facilitate your plan for job progress.

2. A trained demonstrator installs the system carefully, instructs your men in its operation, remains on the job until it's going ahead "in the dry".

3. From start to finish, each job receives individual attention. Because of this, and superior equipment, less units do the work – in shorter time – with correspondingly *lower final costs*. Results are guaranteed.

This procedure, followed consistently for thirty five-years, has been responsible for our constant growth and progress in the wellpoint industry.

If you'd like further information on what a Moretrench Wellpoint System can do, send for our catalog.

MORETRENCH CORPORATION:

Without obligation, please send me your catalog, "The Moretrench Wellpoint System".

Name____________________

Firm____________________

Address____________________

____

MORETRENCH CORPORATION

90 West St.	4900 S. Austin Ave.	7701 Interbay Blvd.	315 W. 25th St.	Rockaway
New York 6	Chicago 38, Illinois	Tampa 9, Florida	Houston 8, Texas	New Jersey
CO 7-2283	Portsmouth 7-4212	Tampa 61-1881	Underwood 4-7774	Oakwood 7-2100

Western Representative: Andrews Machinery of Washington, Inc., Seattle 4, Washington

Canadian Representative: Geo. W. CROTHERS Limited, Toronto, Ontario

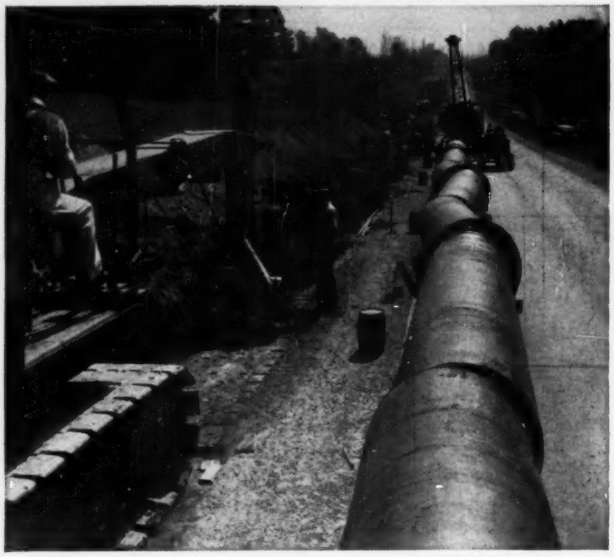
Brazilian Representative: Oscar Taves & Co., Ltd., Rio de Janeiro


The winner's in the bag...

With hundreds of engineers voting—

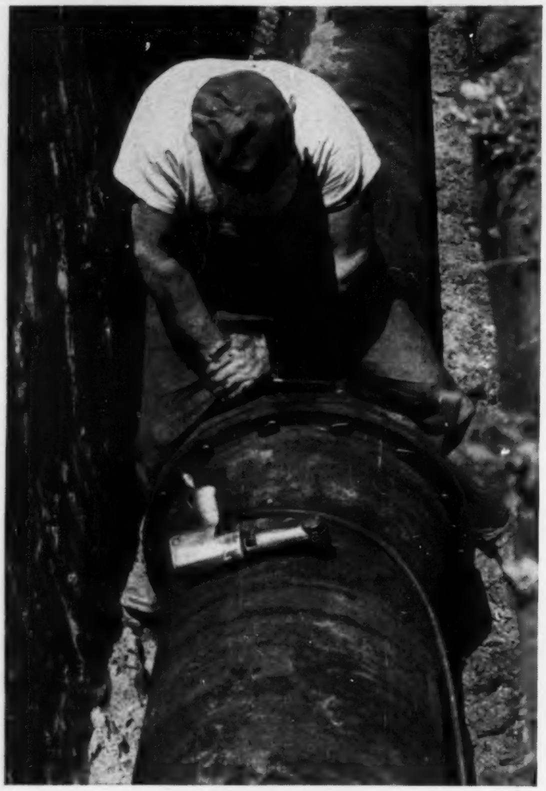
IT'S CAST IRON PIPE BY A

A country-wide survey of consulting engineers, just completed, asked this question: *What kind of pipe do you prefer for water distribution, and why?* Of the answers received, by far the greatest number named cast iron! Here are typical comments:



"This is known to be of 100-year life, and is the preference of this office when cost over this period can be used."

—Florida

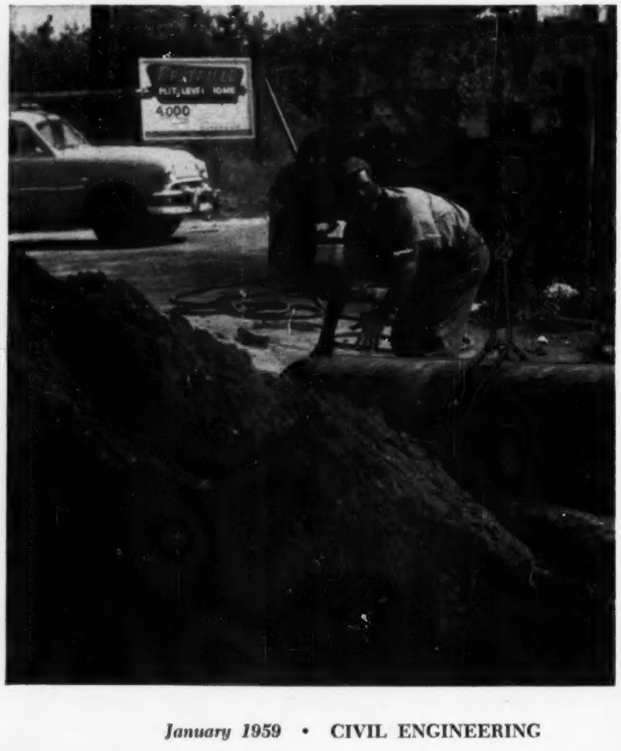


"Our experience in the use of pressure pipe in the installation of water mains servicing communities has been limited entirely to cast iron. We have used nothing but cast iron all the way from 4" to 24" in diameter and have never regretted having done so."

—Texas

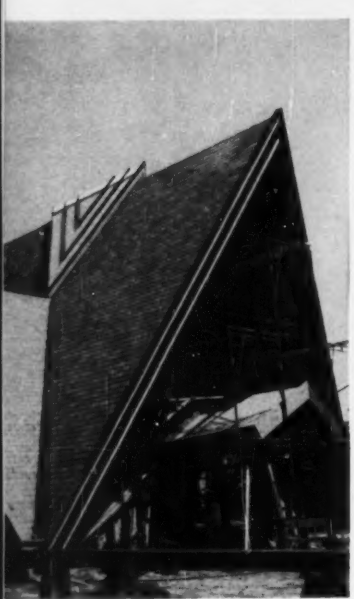
"Longer length of life—comparative ease of installation—agrees with codes more readily."

—Ohio



Residence in California

Design with steel...

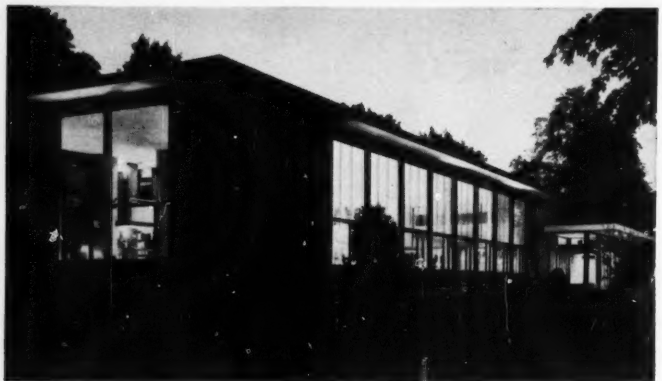


Church in California

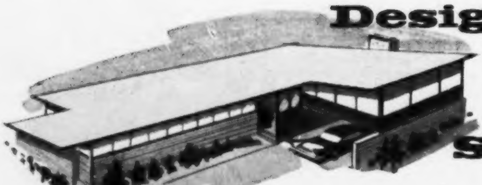
Imaginative design.

Steel framing challenges the designer's imagination. It offers unlimited possibilities for bridges, schools, churches, houses, parking structures, industrial buildings. Structural shapes are readily adaptable to many architectural forms. When left exposed, many striking effects are possible.

Interior of house above



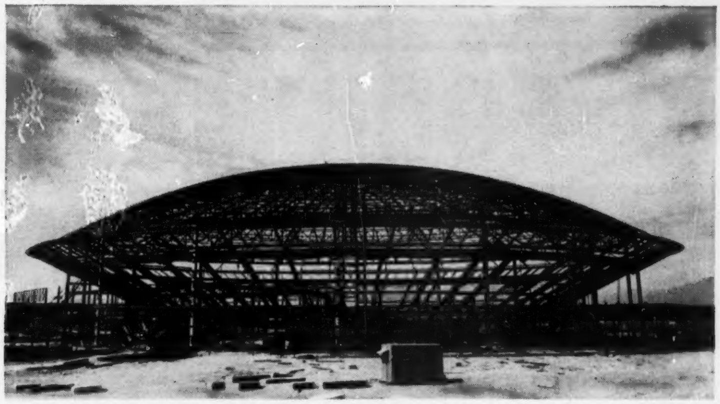
Library in New Jersey



Design with steel...

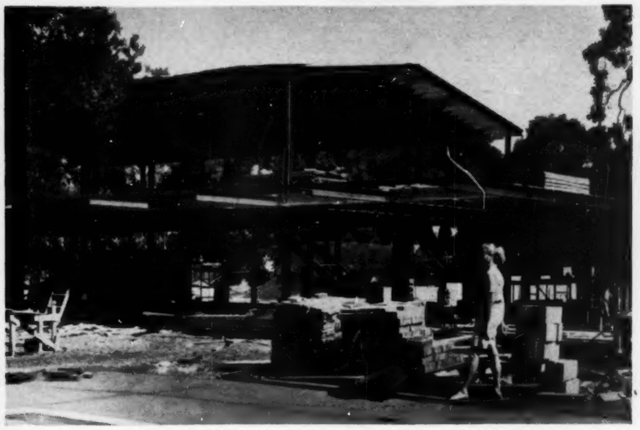
Build with steel...

Steel makes sense



Convention Center in Nevada

Build with steel...



Steel frames go up quickly... leading the way to fast completion

Fast Erection.

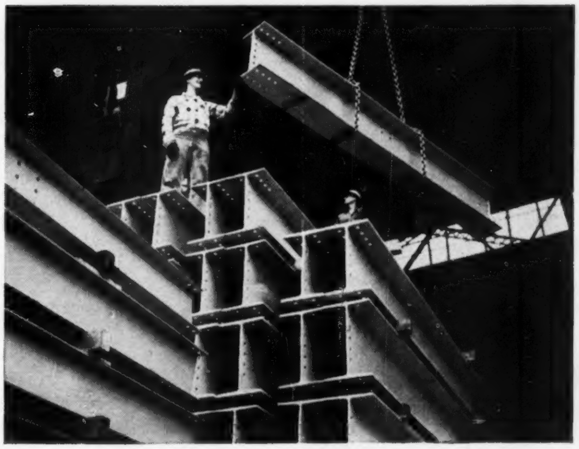
Steel framing goes up faster than any other type of fire-safe material. It can be set in any kind of weather in which men can work. Other trades can move in quickly to speed the building's completion. Another important time-saver: high-strength bolts, which eliminate the need for field riveting.

High-strength bolts speed erection

Steel makes sense

Ample Supply.

Expanded production facilities by the steel industry (and by Bethlehem Steel in particular) assure you of an ample supply of all the structural shapes you need, when you need them. To all the reasons above why steel framing makes sense, add these: it's permanent; it's compact; it's adaptable; it keeps costs low; it's unsurpassed for strength.

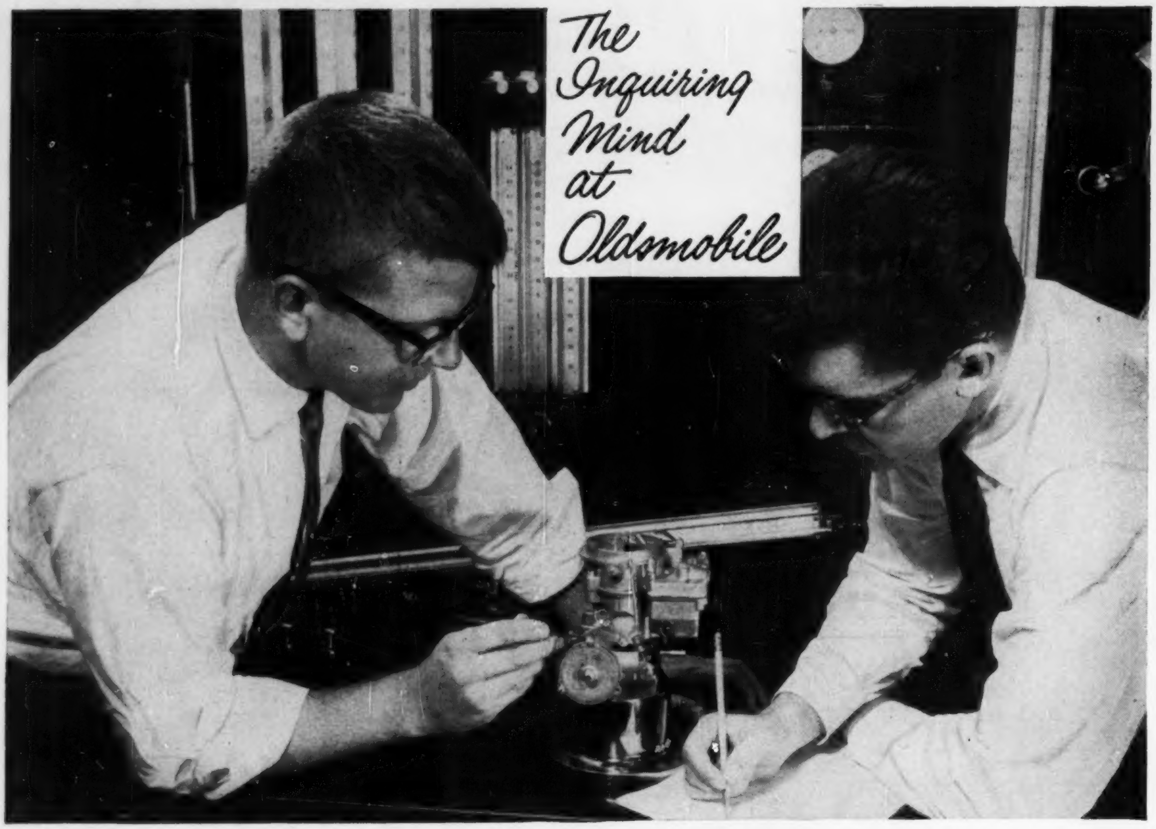


Today, Bethlehem is able to turn out nearly 3 million tons of shapes each year. The supply is ample.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



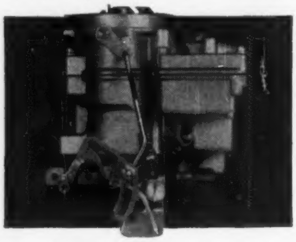
no. 6 OF A SERIES

TWO STEPS TO NEW FUEL ECONOMY

Unique Oldsmobile-developed two-stage automatic choke is a major step forward in improving automobile operating economy.

One of the important carburetor developments during the past few years was the automatic choke, a device that allows the automobile to be started in cold weather, and then keeps it running until the engine is sufficiently warmed up to sustain itself. Every automatic choke has two separate functions: 1) choking, which enriches the fuel-air mixture for starting, and 2) the idle speed control, which keeps the engine from stalling once it is started. In the past, and on all present carburetors except those used on the 1959 Oldsmobile, these two functions have operated simultaneously with the result that the engine ran on a rich mixture for the same length of time that the fast idle was "on". This resulted in excess fuel consumption.

With the introduction of the 1959 Oldsmobile, the two functions have been separated with a new and exclusive two-stage automatic choke developed by Oldsmobile engineers. An ingenious system of over-running levers allows the choke fly to open 75% sooner than previously required. The fast idle, however, remains "on" for the full warm-up period so the engine will not stall. This early elimination of the choking function represents a considerable fuel saving in cold weather when numerous short trips are made.



At Oldsmobile the Inquiring Mind is always at work, finding new and better ways to design, engineer and build finer automobiles for the most discriminating of buyers—the Oldsmobile owner. Discover the difference for yourself by visiting your local Oldsmobile Quality Dealer and taking a demonstration ride in a 1959 Oldsmobile.

OLDSMOBILE DIVISION, GENERAL MOTORS CORPORATION

OLDSMOBILE

Pioneer in Progressive Engineering ...Famous for Quality Manufacturing

FIGURES recently compiled by a leading architectural magazine show that 100 top U. S. corporations represented 14.5% of the total 1957 U. S. spending for industrial and commercial construction. Raymond was selected to install foundations for 89 of these 100 biggest buyers of building services.

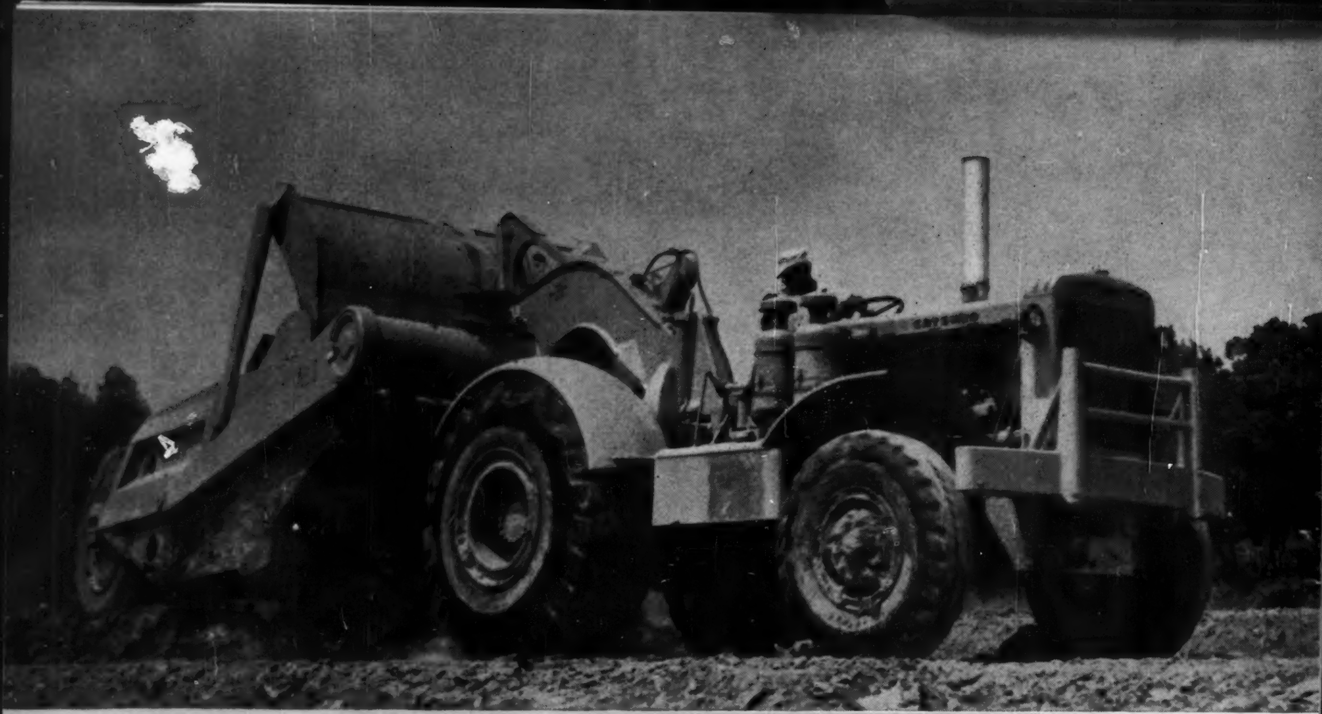
Naturally, we're proud of this record, but foundations for industrial and commercial construction account for just one part of Raymond's scope. We are also active in providing the supports for the Nation's highway program, constructing waterfront and offshore projects, as well as undertaking countless soil investigations. Overseas, Raymond is thoroughly equipped to fulfill contracts for complete construction projects of all types.

If you're interested in foundations, heavy construction or general construction abroad, we may be able to help you. Please write or give us a call.

RAYMOND
CONCRETE PILE COMPANY

A Division of Raymond International Inc.
140 CEDAR STREET, NEW YORK 6, N. Y.
Branch Offices in principal cities of the United States. Subsidiaries in Canada, Central and South America.

FOUNDATIONS FOR THE STRUCTURES OF AMERICA . . . COMPLETE CONSTRUCTION SERVICES ABROAD



NEW DW20
Series G

NEW No. 456
Series B

NEW HP —345 (maximum output)—increased 8%

NEW RIMPULL —39,565 lb. (maximum)—increased 12%

NEW SPEEDS —increased rimpull—provides up to 20% faster travel speeds under normal haul road conditions

NEW CAPACITY—19.5 cu. yd. (struck)—increased 8%
27 cu. yd. (heaped)—increased 8%

NEW DW21
Series G

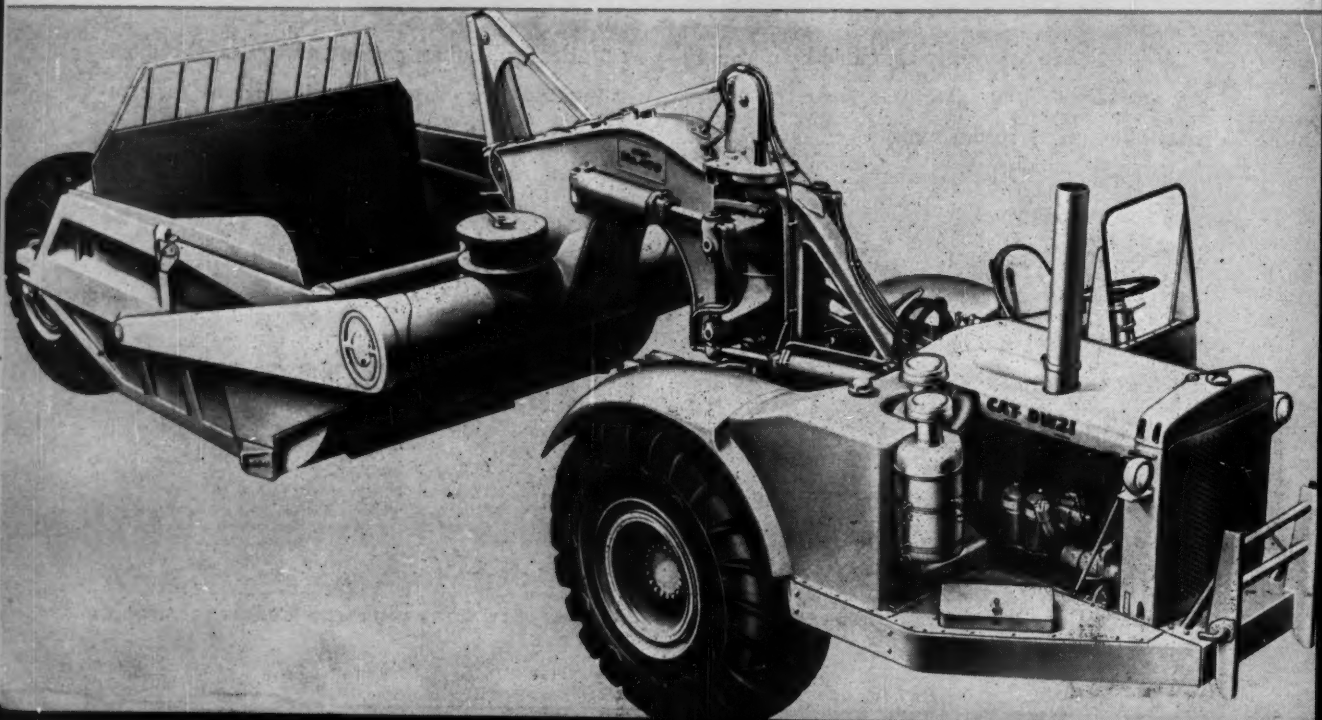
NEW No. 470
Series B

NEW HP —345 (maximum output)—increased 8%

NEW RIMPULL —49,100 lb. (maximum)—increased 12%

NEW SPEEDS —increased rimpull—provides up to 20% faster travel speeds under normal haul road conditions

NEW CAPACITY—19.5 cu. yd. (struck)—increased 8%
27 cu. yd. (heaped)—increased 8%



NEWS OF ENGINEERS

John W. Bell has joined the Harold T. Smith International, a South American organization, as project manager for its operations in Libya. Mr. Bell will be in charge of the exploration and development of wells for towns and villages, the design of transmission and distribution systems, and the supervision of construction under a contract the firm has with the Libyan American Joint Health Services, which is financed by the International Cooperation Administration.

John W. Bell

Walter E. Joyce, a specialist in the design and construction of suspension bridge cables, is retiring as senior associate with D. B. Steinman, consulting engineers of New York, N. Y., after fifty-one years in the engineering field. Mr. Joyce's work has included the construction of the cables for the George Washington Bridge in New York, the Golden Gate Bridge in California, and the Mackinac Bridge in Michigan. Mr. Joyce is author of an article on the cables for the Mackinac Bridge in this issue.

Edward G. Herb, retired Colonel, Corps of Engineers, was recently elected administrative vice president of International Engineering Company, Inc., of San Francisco, Calif., a subsidiary of the Morrison-Knudsen Company, Inc. Colonel Herb, who was previously with the New York International Office of Morrison-Knudsen, joined the company in 1955 shortly after retiring from the Army. Colonel Herb holds the Legion of Merit "for exceptionally meritorious conduct in performance of outstanding service in the rehabilitation of the Port of Cherbourg."

Robert F. Hastings, an executive vice president of Smith, Hinchman and Grylls, a Detroit architectural and engineering firm, has been elected president of the Detroit chapter of the American Institute of Architects.

Edward G. Wetzel, assistant chief of the planning division of the Port of New York Authority, has been elected a vice president of the Institute of Traffic Engineers. Mr. Wetzel has been with the Authority for over ten years.

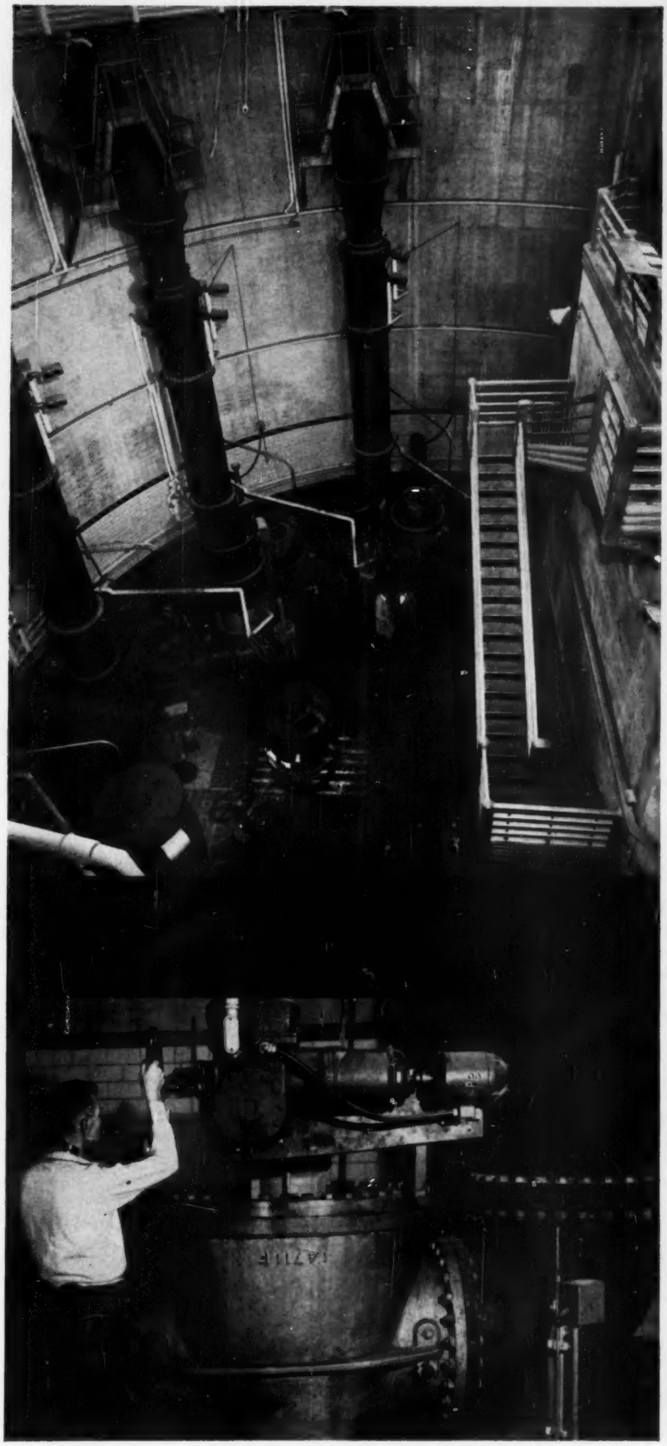
Conrad W. O'Connell has been appointed chief engineer of the Plainfield-Union Water Company, with headquarters in Plainfield, N. J. Mr. O'Connell returns to his native state from Pasadena, Calif., where he was general manager of Bailly Engineering Enterprises. In the past he has been general manager and chief engineer of the New York Water Service Corporation and water supply engineer on various North and South American projects.

Louis Berger & Associates, with offices in Harrisburg, Pa., announce the opening of civil engineering offices in Geneva, Switzerland. The Geneva office will carry out civil engineering projects in Europe, Africa, the Middle and Far East.

A M Rawn, of Los Angeles, Calif., is retiring as chief engineer and general manager of the Los Angeles County Sanitation Districts, after long and distinguished service with the organization. His home address is 301 Crown Drive, Los Angeles 49, Calif. Mr. Rawn became an Honorary Member of ASCE.

Hardy Cross (left), Honorary Member of ASCE and professor emeritus of civil engineering, Yale University, receives the Gold Medal of the Institution of Structural Engineers of England, its highest award, for "outstanding contributions to the science and art of structural engineering." The presentation, which was made as part of the Jubilee Celebration of the Institution by its president, G. S. McDonald, is only the fourth award of this medal in the fifty-year history of the Institution and the second to an engineer not a member of the Institution. Later, Professor Cross spoke on "The Relations of Structural Mechanics to Structural Engineering."

(Continued on page 20)



SMS-Rotovalves On Sewage Pump Discharge

GIVE ACCURATE THROTTLING

At Philadelphia's Southeast and Central Schuylkill Pumping Stations, twelve SMS-Rotovalves with electric operators are installed at the discharge ends of vertical centrifugal pumps. These 30-inch Rotovalves were chosen for their reliability of operation and ability to throttle pump discharge accurately.

Their full-line opening cuts pressure loss to lower pumping costs. Self-purging, monel-to-monel seats are out of the stream, and less subject to wear. Rotovalves give quick, easy throttling operation. Bronze trunnions eliminate friction as the plug first lifts, then turns, finally reseats in the desired position. For emergency closure, maximum initial shut-off eliminates sufficient line surge shock to prevent damage to pump parts.

You can obtain full information on SMS-Rotovalves, as well as the complete line of Ball Valves and R-S Butterfly Valves, by contacting our nearest representative. Or, write to S. Morgan Smith Company, York, Penna.

◀ *Overall view shows dry well and discharge risers. Close-up (lower photo) shows a 30-inch Rotovalve equipped with electric motor-driven operators.*

S. MORGAN SMITH HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED

6

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

NEWS OF ENGINEERS

(Continued from page 18)

Charles A. Blessing, director of city planning for Detroit, Mich., has been elected president of the American Institute of Planners. Recently, he was honored by the West German government as one of ten architects and planners selected to visit Germany. Mr. Blessing's background includes top planning positions at local, state, and federal levels. Mr. Blessing has been active in the ASCE City Planning Division, which he served as chairman for two years and as a member of the committee that produced the report, "Technical Procedures for City Surveys."

Ernest E. Michaels, president and a director of Chicago Bridge and Iron Company, Chicago, has been unanimously elected to a three-year term as chairman of the Welding Research Council of the Engineering Foundation. Mr. Michaels has spent his entire career with the Chicago Bridge and Iron Company, starting there as an engineer in 1922.

E. E. Michaels

Gene M. Nordby, head of the department of civil engineering at the University of Arizona, has been appointed to the Engineers Joint Council Committee on Engineering Sciences. The Committee on Engineering Sciences is appointed to cooperate with the National Science Foundation and other government agencies in initiating and developing basic research in engineering sciences. Dr. Nordby has also served as program director for Engineering Sciences for the National Science Foundation.

M. F. Lindeman, associate professor of civil engineering at the University of Illinois, announces the opening of an office in Springfield, Ill. Mr. Lindeman, whose specialty is structural engineering, is offering consultation and engineering services on foundations, buildings, and bridges.

Donald A. Booth has been promoted to assistant engineering manager of the Dravo Corporation, Pittsburgh, Pa. Mr. Booth joined the firm shortly after graduating from Cornell University in 1935. For several years he was general mechanical superintendent of the Engineering Works Division and more recently has been chief draftsman.

Stephen F. Voorhees, announces the continuation of his architectural practice under the new firm name of Voorhees Walker Smith Smith and Haines. The firm will remain at its present offices at 101 Park Avenue, New York, N. Y.

George A. Hess has been appointed a project engineer for the J. Y. Long Company, engineers of Oakland, Calif. Mr. Hess was formerly vice president and chief engineer for Rosener Engineering, Inc., of San Francisco, having served in several capacities in the Rosener organization since 1945.

Stuart S. Neff announces his retirement as representative for the office of J. Fruchtbaum, Knoxville, Tenn. The firm of J. Fruchtbaum recently completed supervising construction of a group of buildings for the International Graphite and Carbon Company of Niagra Falls, N. Y. Mr. Neff is now living in Oak Ridge, Tenn.

Oliver L. Clevenger has been promoted from civil engineer to senior supervising engineer in the Technical Division at the Humble Oil & Refining Company's Baytown, Tex., refinery. He is supervising a group of engineers engaged in the mechanical designing of refinery piping and equipment. Mr. Clevenger recently graduated from the University of Texas.

A. C. Hardison has become the first southern Californian and only the sixth man in history to win a California Farm Bureau Federation Gold Medal. The medal was conferred on Mr. Hardison at the group's 40th annual convention in San Jose recently. The only surviving original partner of the Limoneira Company, world's largest lemon ranch, Mr. Hardison has also been a director of the Exchange Lemon Products Company since its inception, second president of the state Farm Bureau Federation, and a member of the executive committee of the American Farm Bureau federation. He has been instrumental in the development of more efficient irrigation practices, and is credited with much of the success of Sunkist Growers, the nation's outstanding farm marketing organization.

Herbert J. Flagg is retiring as chief engineer and executive officer of the Board of Public Utility Commissioners of Newark, N. J., after twenty-one years service. He is now available as a consultant on problems relating to the regulation, management, and operation of public utilities. His office is at 179 Harrison Street, East Orange, N. J. Major Flagg has been secretary and chairman of the ASCE Power Division.

H. J. Flagg

Martin Wohl, instructor in civil engineering at the Massachusetts Institute of Technology, received the 1958 Past Presidents' Award of the Institute of Traffic Engineers for his paper, "Vehicle Speeds and Volumes Using Sonne Stereo Continuous Strip Photography," at the Institute's 28th Annual Meeting in Miami Beach, Fla. **Edmund J. Cantilli,** highway project planner with the Port of New York Authority, was voted an honorable mention for his paper.

(Continued on page 22)

THE NEW **JACKSON** TRAILER COMPACTOR

Push or Pull it...

WITH *ANY PRIME MOVER

TEAMMATE OF THE FAMOUS **JACKSON MULTIPLE COMPACTOR** which was used exclusively for the compacting of sub-bases on the highly critical A.A.S.H.O. TEST ROAD and most all major highway projects. An excellent means of providing compaction at its quickest and best is offered in the choice of these two machines.

For the host of contractors acquainted with the outstanding performance of the Jackson Multiple Vibratory Compactor, the advent of the new TRAILER COMPACTOR **will be great news. For here is a machine basically similar, costing considerably less, that can be** PUSHED or PULLED BY *ANY PRIME MOVER CAPABLE OF SLOW (50 f.p.m.) WORKING SPEEDS . . . TOWED TO LOCATION AT ANY ROAD SPEED . . . OPERATED IN EITHER DIRECTION, NO TURNING OR BACKING NECESSARY . . . REMOTELY CONTROLLED BY OPERATOR OF PRIME MOVER. WORKHEAD MAY CONSIST OF 3, 4, 5, or 6 VIBRATORY UNITS, **(each developing 6,000 lbs. of force at 4200 RPM)** OR TWO WORKHEADS OF 4 UNITS EACH MAY BE EMPLOYED. INDIVIDUAL UNITS MAY BE DETACHED AND OPERATED SEPARATELY. POWER PLANT SUPPLIES BOTH SINGLE AND 3-PHASE 110-150 VOLT, 60-80 CYCLE AC AND HAS MANY USES.

Write, wire or phone for additional information.

JACKSON VIBRATORS, INC. LUDINGTON, MICH., U.S.A.

NEWS OF ENGINEERS

(Continued from page 20)

Park H. Martin, Honorary Member of ASCE, recently retired as executive director of the Allegheny Conference on Community Development and the Pittsburgh Regional Planning Association. Mr. Martin will continue his connection with the organizations by acting as a consultant. He will also do consulting work for the University of Pittsburgh and the County of Allegheny. Mr. Martin is a member of the new ASCE Task Committee on Transportation.

John M. McNerney was recently appointed manager of the Portland Cement Association's Western Regional Office. Mr. McNerney has been with the Association for over fifteen years. **Walter E. Kunze, Jr.,** assistant manager of the PCA Structural and Railways Bureau, is taking over new duties as manager of personnel training. Mr. Kunze, who joined the firm as a structural engineer in 1952, has participated in the past year as an instructor in the personnel training program.

Odd Albert, associate professor at Brooklyn Polytechnic Institute, Brooklyn, N. Y., has been appointed state (New Jersey) chairman of the Committee on Civilian Defense. Professor Albert is also a member of the physics department of Monmouth College in New Jersey.

Gordon L. Kirjassof, Joseph W. Lavin, George H. Leland, and **H. Jack Leonard** have been admitted as partners into the firm of Edwards and Kelcey, engineers and consultants, with offices in Newark, N. J., Boston, Mass., Salt Lake City, Utah, and New York, N. Y.

Hans H. Sonderegger has been appointed director of engineering and research for the Gifford-Wood Company of Hudson, N. Y. Mr. Sonderegger, an expert in the field of conveyor engineering, has been associated with Sauerman Brothers, Inc., of Belwood, Ill., and the Link-Belt Company, of Chicago.

H. Sonderegger

Walter O. Boessneck, office engineer for the Erie Railroad Company at Cleveland, Ohio, is retiring after more than forty-two years with the company. Mr. Boessneck did the design and estimates for railroad-highway grade crossing elimination projects throughout Ohio and New York. **Samuel B. Gill,** also of the Erie Railroad Company, has been appointed principal assistant engineer.

H. Loren Thompson, partner in Stevens & Thompson Engineers, Portland, Ore., is the 1958 "Oregon Engineer of the Year," an award of the Professional Engineers of Oregon "in recognition of his outstanding works of engineering in Oregon and his contributions to the advancement of the engineering profession." Among his many engineering honors have been the presidency of the Oregon Section of ASCE and the presidency of the PEO in 1954. Mr. Thompson was general chairman of the ASCE Convention held in Portland last summer.

Cyrus R. Bird is retiring from active association with the Pitometer Associates. Mr. Bird joined the firm in 1919, and at the time of his retirement was Western district manager and vice president in charge of the Chicago office. **W. D. Hudson,** who will succeed him, joined the firm in 1941, and in 1957 was promoted to principal engineer. He has been in charge of the Atlanta office since 1950.

Hugh D. Barnes is the new assistant vice president of the Portland Cement Association of Chicago, Ill. Mr. Barnes, who earlier this month was appointed supervisor of field promotion after serving for two years as manager of the PCA Western Regional Office in Los Angeles, Calif., will have complete authority and responsibility for all operations of the Association's 32 district and 6 regional offices.

THE NEW ALLIS-CHALMERS TS-260

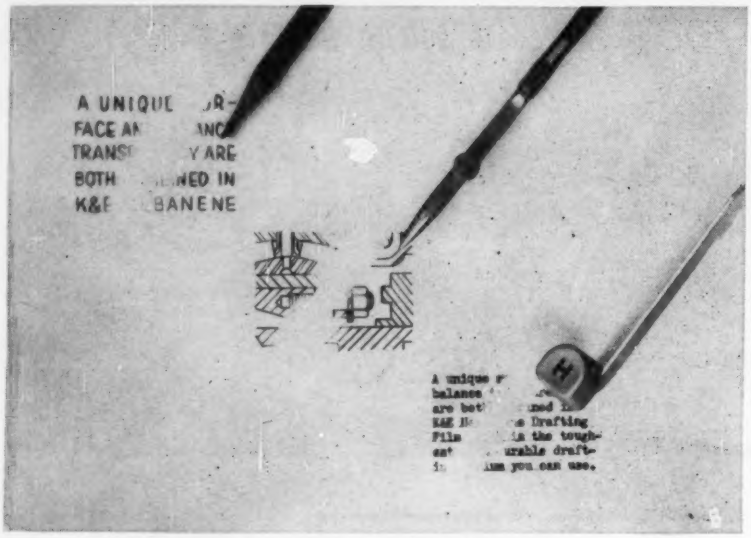
More profit capacity for you than anything near its size!

230 HORSEPOWER • 17 YARDS HEAPED

Here's news worth swinging around to see...

For two years, the TS-260 has been the hottest motor scraper in the business . . . and now it's even better. If you're looking for new ways to boost net profit on your earthwork, we invite you to check these facts . . . then compare the new TS-260, dollar for dollar, with *any other make.* And since words don't really prove a thing, we hope you'll compare *on the job.*

Some Ideas for your file of practical information on drafting and reproduction from KEUFFEL & ESSER CO.



Now you see it . . . now you don't. Pencil, ink and typing all register sharply, erase completely on the K&E "engineered surface."

The K&E "Engineered Surface"

All K&E paper, cloth and film has one extremely individual characteristic. It's what K&E calls its "engineered surface"... a unique surface designed and applied by K&E, right in its own plant, to every roll and sheet of prepared tracing paper, cloth and film. It means controlled drafting qualities far beyond anything the base material alone can normally provide, with a surface tooth that's exactly right and uniform. Whatever's penciled, inked or typed onto it goes on crisply and sharply . . . shows up clearly and stays that way. Furthermore, the "engineered surface" lets you erase if you want to, easily and quickly and without any of those leftover ghost lines that drive you crazy when they show up in reproductions. And remember, only with K&E do you get all the advantages of an "engineered surface," no matter which paper, cloth or film you're interested in.

About HERCULENE (TM) The Newest of Films

Frankly, we think K&E Herculene Drafting Film is a real discovery. It has all the properties of the K&E "engineered surface" . . . exceptional "take," adhesion and erasability . . . plus the toughness and durability of its Mylar® base. What's the latter? It's a polyester film, developed by DuPont, that's uncommonly strong and virtually indestructible . . . waterproof and almost immune to the effects of age, heat, ultraviolet exposure and handling. With our K&E "engineered surface" added, it becomes K&E Herculene Drafting Film . . . the toughest, most durable drafting medium yet to reach the drafting room. And the surface will last indefinitely, without flaking off or chipping off.

Some Points About Paper...

K&E Albanene® Tracing Paper is the largest selling tracing paper in the world today. Why? Because Albanene is the *only* prepared tracing paper which has an "engineered surface." All other brands depend for their pencil tooth solely on the natural surface texture of the paper itself, which varies from fine to coarse . . . often on the same sheet.

Albanene invariably gives you sharp, clear pencil lines, superb reproductions. It has a solid transparentizer that is chemically stable and can't leak out, ever. This permanent transparentizing means that you'll never get white, opaque spots, even from contact with drafting tape. Try the drafting tape test yourself.

. . . and its package

And now, all Albanene paper in rolls is packaged in the new square carton for better protection and easier storage. Your rolls stay neat and clean while in use, and the cartons will do double duty in helping you to store finished tracings. In fact, some companies are rearranging their filing systems by using Albanene cartons, which hold large numbers of rolled-up drawings and stack simply and neatly.

Some Facts About Cloth

When you want cloth, think first of K&E Phoenix® Tracing Cloth. Besides the K&E "engineered surface" with the superb "take", adhesion and erasability for pencil, ink or typing, K&E Phoenix has all the advantages of a water-resistant, chemically-inert coating that won't soften even under high heat and won't discolor, become brittle or flake off the base. You can even clean both sides with a damp cloth, without worrying about moisture stains.

And Some Tips On Erasing

All K&E drafting media give you excellent erasability, but there's a right way to erase on each one. On cloth and film, harsh, gritty erasers can destroy the surface. You'll get the best results with plastic erasers, such as the Richard Best "Tad" and the Eberhard Faber "Race Kleen." Moisten them for removing ink and stubborn typing; use them as they are for removing pencil lines. Large areas of ink can be removed completely without damage by using a moist cloth and Bon Ami cleanser. On Albanene, electric erasing machines are fine if used with a soft eraser.

The Choice Is Up To You

When it comes to selecting K&E paper, cloth or film for the job at hand, we have to leave the choice to you. We're not being indecisive . . . it's just that you're the only one who knows the particular problem you have and which product solves it best. But remember . . . K&E has a *complete* line of paper, cloth and film . . . and only K&E puts a special "engineered surface" on all three media to provide a well-balanced, uniform surface suited to the base material.

KEUFFEL & ESSER CO., Dept. CE-1, Hoboken, N. J.

Please send me more information and samples on the following:

☐ K&E Herculene ☐ K&E Albanene ☐ K&E Phoenix

Name & Title____________________

Company & Address____________________

____________________ 1277

. . . . . Am-Soc Briefs

▶ ▶ Congratulations to the five Sections who have gone over the top in the ASCE Member Gift Campaign for the United Engineering Center. In the order of meeting their quotas, they are the Kentucky, Lehigh Valley (with 115 percent), Nashville, Cincinnati, and Columbia Sections. . . . As of December 12, member giving for the Center has passed the half-way mark, with $1,519,209 collected or pledged. . . . On the debit side, only 3,296 ASCE members had contributed on that date. The Member Gifts Committee is hoping to hear soon from the other 39,000 members. . . . There is more about the campaign in the Society News section.

▶ ▶ ASCE has scored another victory in its fight against the practice in some state highway departments of inviting or taking bids for professional engineering services. The Attorney General of South Carolina recently ruled that it is not mandatory, under South Carolina state law, for the Highway Department to advertise and accept bids for professional engineering work — an interpretation the Society has long been seeking.

▶ ▶ Is the cold weather getting you down? The Hawaii Section's Post-Convention (Los Angeles) Tour is your chance for a perfect vacation in the world's most felicitous climate. There will be technical sessions and a variety of native entertainment as well as the ten-day sightseeing tour of the Islands, which will keep engineers' special interests in mind. Tours, starting at $432 and $510, take off from Los Angeles on February 16. Inquiries should be sent to the Reservations Committee, ASCE Post-Convention Tour, P.O. Box 8084, Honolulu, Hawaii.

▶ ▶ The program for the Los Angeles Convention (page 67) is in keeping with Society policy of offering enough in every civil engineering field to make it worth while for the specialist to attend. City planning, flood control, and earthquake problems receive lots of emphasis in the 130 papers.

▶ ▶ Civil engineers qualified to do basic research will be interested in the new $5,000 Research Fellowship ASCE has established. The important grant, aimed at the advancement of the profession through the creation of new knowledge, will be made annually from current Society income. The rules are listed in the Society News Section and in the forthcoming 1959 Official Register. Applications for the first award are due March 15.

▶ ▶ The best that has been thought and said in the civil engineering field is how "Transactions" might be described. A new volume (for 1958) is now ready in the long series that goes back to 1872. For those who overlooked ordering, the details are available in the December issue (page 91).

do you know that

Progress in urban renewal is on a national scale? Cities and towns that have embarked on long-range plans to end slums and blight are located in 42 of the 49 states and comprise about half the nation's urban population. Included are 390 cities and towns with a population of 2,500 or more. Seventeen of the 18 cities with a population of over half a million have approved programs; the eighteenth, Houston, is said to have a program in preparation. For this information we are indebted to "Onward & Upward: Growth Trends Resumed," a preview of construction potential in the *Architectural Record* for November.

• • •

Oroville Dam will be the highest earthfill? With the decision of California's Water Resources Department to make Oroville Dam 730 ft high, it will top by over 200 ft the previous earth dam record held by the recently completed Swift Dam on the Lewis River. A key feature in the state's $1.6 billion Feather River Project, Oroville Dam will also top Hoover Dam by a few feet, making it the highest dam of any kind in the United States. Economy was the chief reason for the decision to make Oroville an earth dam. Its cost is put at about $445,000,000, considerably less than the estimated cost of the concrete gravity dam originally planned.

• • •

A- and H-bombs have their peacetime possibilities? Eventual use of the dread bombs to move large masses of earth and rock, extract oil from low-grade shale deposits, and achieve other peaceful objectives was foreseen by two University of Michigan researchers in recent testimony before the Atomic Industrial Forum. The AEC's experiment with the use of atomic weapons for peaceful purposes is called Project Plowshare.

• • •

Massachusetts has passed a law requiring registration of engineers and land surveyors doing business in the state? Until passage of the law making registration mandatory by December 26, 1958, Massachusetts was the only state (including Alaska) that permitted registration to be optional. Engineering groups were staunchly behind the new legislation.

• • •

California gets 80 to 90 percent of all U. S. earthquakes? Even so, it has no monopoly on "high risk areas" in the nation, according to Charles F. Richter, professor of seismology at California Institute of Technology, who has just completed a survey of where the most damaging quakes are likely to occur. High risk areas, as evaluated by Professor Richter, are in California, parts of northern New York State and New England, the central Mississippi Valley, and a narrow north-south belt extending through parts of Idaho, Montana, Utah, and Arizona. Local geology, proximity to active faults, and tremblor history were among the factors taken into consideration.

• • •

Earnings of engineers are continuing upward? The good news comes from Engineers Joint Council, which is announcing its new biennial survey of engineers' salaries, said to be the most comprehensive ever published in the United States (see page 75). The data are derived from the largest sampling ever studied—over 190,000 engineers. EJC is accepting orders at $3.00 a copy. Requests should be sent to 29 West 39th Street, New York 18, N. Y.

• • •

Highway expenditures by all units of government will be about $6.2 billion in 1958? This is a 10 percent increase above the 1957 total of $5.7 billion. The Bureau of Public Roads also forecasts that annual capital expenditures will reach $7.1 billion in 1959, $7.3 billion in 1960, $7.7 billion in 1961, and $8.1 billion in 1962. Notable in the Bureau's forecast is the expected decline in annual capital expenditures for toll facilities from $500 million in 1958 to $75 million in 1962.

• • •

The U. S. will need at least 425,000 new college teachers between now and 1970? The issue was put before participants in New York University's annual Higher Education Conference held this December. The number will include 30,000 teachers of engineering, listed as one of the fields of "most acute shortage." The teachers will be needed to instruct an expected college enrollment of 6,000,000 students in 1970. The present enrollment is 3,200,000.

• • •

A new electronic-telemetering system makes it possible to measure the water content of mountain snowpacks? The system—developed by the Corps of Engineers and the Sierra Electronic Corporation—has been placed in operation this winter in California's Sierra Nevada mountains and in the Bitterroot mountain range in Idaho. The unique snow-gauging equipment, based on a radiation detector of the scintillation type, enables engineers to obtain accurate hydrological data from remote areas.

• • •

Holland is slowly getting larger? Each year reclamation engineers are draining and drying more of the country's once huge Zuiderzee. In 1958 some 20,000 acres of fertile farmland were gained under Holland's third large land reclamation project. The December issue carries an article on the project.

CIVIL
ENGINEERING

Ethics in public practice

R. ROBINSON ROWE, M. ASCE,
Principal Bridge Engineer,
California Division of Highways,
Sacramento, Calif.

The Code of Ethics of the American Society of Civil Engineers is fully as applicable to engineers in public practice as it is to those in private practice. In discussing the applicability of the Code article by article, my aim is not to cover all possible applications but rather to stimulate individual interest and to call attention to those acts which affect the stature of the profession.

The Code consists of ten articles, of which the first is:

It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers:

Article 1. To act for his clients or for his employers in professional matters otherwise than as a faithful agent or trustee, or to accept any remuneration other than his stated charges for services rendered his clients.

In public practice the public is the employer as well as the client. Since the engineer-client relationship is less direct than in private practice, the public engineer-employee must be unusually circumspect in his professional acts, particularly when serving as trustee in the expenditure of public funds. No matter how modest his salary, it must be his only remuneration for his service *to the public* (but see Article 8). Gifts or social favors that might conceivably influence his judgment or actions cannot be accepted from contractors, materials agents, or lobbyists.

Article 2. To attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects, or business of another engineer.

This article is applicable to the public employee, not only in his relations with his fellow employees but also with engineers in private practice. The temptation to disregard this article may be greater for engineers in public employ than for others because of the element of immunity from retaliation that protects public servants. Criticism of fellow engineers is permissible if it is honest, fair, and devoid of malice, but careless or deliberate slander cannot be condoned.

Article 3. To attempt to supplant another engineer after definite steps have been taken toward his employment.

This article governs public employees in competition with their fellows. Competition in judgment, training, performance, and promotional examinations is wholesome in developing professional competence for each responsible position, but none should be filled with a "fair-haired boy."

Article 4. To invite proposals for the performance of engineering services or to state a price for such services in response to any such invitation, when there are reasonable grounds for belief that price will be the prime consideration in the selection of the engineer.

Although adopted recently to restrict competitive bidding by engineers in private practice, Article 4 begins by condemning the invitation for such bidding. On public projects, it is the engineer in public practice whose official acts in negotiating for engineering services should follow ethical procedures.

Article 5. To compete with another engineer for employment on the basis of professional charges, by reducing his usual charges and in this manner attempting to underbid after being informed of the charges named by another.

In this article "charges" refers primarily to "fees" but in principle the Code applies to "salaries" as well. In public practice outside the organizations staffed by civil service and merit systems, many agencies recruit by invitations to engineers to submit a statement of qualifications and least acceptable salary. The opportunity for and undesirability of underbidding is obvious.

Article 6. To review the work of another engineer for the same client, except with the knowledge or consent of such engineer, or unless the connection of such engineer with the work has been terminated.

This article may appear to conflict with the policy of many public engineering organizations in their systems of "checks and balances," in which project reports and other matters run the gauntlet of criticism from many subagencies. However, to the extent that it is systematic, the routine review of the work of other engineers in the public service must be called "with the knowledge or consent" of all engineers who have accepted employment in the agency. Beyond such systematic review, criticism of the work of other engineers should be governed by the rule.

Article 7. To advertise in self-laudatory language, or in any other manner derogatory to the dignity of the profession.

For public employees this article is not concerned with professional cards and other displays, but professional papers and publicity releases, many of which credit agency chiefs for the contributions of their staffs. The offense is so common as to be accepted in many circles for exactly what it is. The careful and dignified chief gives credit where credit is due, and is respected in consequence for the eminence of his staff.

Article 8. To use the advantages of a salaried position to compete unfairly with engineers in private practice.

This article is aimed directly at engineers in public practice, but is quite generally misunderstood. Unless forbidden by a rule of the agency, a public engineer-employee may compete with engineers in private practice, but not *unfairly* through use of his *position*. His fee should not be less because he has no overhead for an office, nor because he borrows public equipment, nor because he does some of his thinking on salaried time, nor because he can adapt office practices to outside problems, nor because he enjoys official contacts with regulating agencies. Educators are encouraged to practice privately so as to teach modern techniques. Civil servants are encouraged to teach privately so as to maintain their technical background and develop their ability to train their staff. Remember the cue word "unfairly"; there is no rule against *fair* competition.

Article 9. To use undue influence or offer commissions or otherwise to solicit professional work improperly, directly or indirectly.

Professional work under this article may be performed for either a fee or a salary, and for the latter it may be in public practice. Competition may be keen for a high-salaried engineering position and competitors believing themselves qualified may solicit appointment. Solicitation implies use of some kind of influence, but it must be limited to emphasis on the applicant's qualifications directed to the attention of the appointing authority.

The ban is on *undue* influence. For the higher positions, there may be hints, or frank demands, for contributions to campaign funds as a condition of appointment or reappointment. Conditional appointments might require, instead of money, that the appointee reciprocate with special favors while in office. The reader's imagination can extend such examples endlessly; even though no money passes, they are forms of bribery, and hence *improper* solicitation.

Article 10. To act in any manner or engage in any practice which will tend to bring discredit on the honor or dignity of the engineering profession.

This final article is the granddaddy of them all—a comprehensive summary of the Code covering intangible principles of conduct. In public as well as in private practice, all professional engineers should strive toward recognition and acceptance of engineering as a learned, honorable and dignified profession.

Because of the vast program of public works, the proportion of Society members in public practice has been steadily increasing, and now exceeds that in private practice. Engineers in public practice are more and more in the news and in the public eye. Their every important act of omission or commission has its effect on public opinion. Even their private lives, if scandalous, are spread in Sunday supplements, to the discredit of the profession named in the lurid headlines.

It is evident that, for the engineer in public as well as in private practice, the Society's Code of Ethics is an obligation governing the individual and a way of life enjoyed by him. If the examples given pointed more toward older men in more responsible positions, the emphasis was accidental. Ethics is a habit learned best by the young. Engineers just starting their careers in public practice have most to gain from the future stature of the profession. They will be known for what they are, and what they do, and how they do it.

(This address by Mr. Rowe is to be presented before the Conditions of Practice session, arranged by the Committee on Engineers in Public Practice, at the ASCE Los Angeles Convention on February 12, 1959.)

Waterproofing buildings below grade

GRAYSON W. GILL, M. ASCE, Architect and Engineer, Dallas, Texas.

Demand for underground parking and increased building services has made the multistory basement of more general interest to designers in recent years, even in buildings of modest size. With this comes wide responsibility for waterproofing against high heads of ground water outside the building.

Before World War II, the waterproofing of deep basements in a few large buildings was the responsibility of relatively few engineers. The typical one-story building of the earlier era presented fewer waterproofing problems. For most of these there was a simple solution, or the waterproofing was ignored by the designers.

Technical literature on waterproofing below ground level is surprisingly meager and reflects basic differences of opinion on the part of the authors. It is difficult to arrive at an adequate solution for a waterproofing problem after reviewing this material, which is listed in the bibliography. It is hoped that the conclusions here given, based on an analysis of the references listed and observation of the results of the several techniques, will stimulate discussion and reports of experience on this subject.

Waterproofing of building structures below grade can be classified generally as integral waterproofing, membrane waterproofing and hydrolithic waterproofing.

Integral waterproofing may consist of any one of a great number of concrete admixtures, ranging from portland cement itself, and lime, to alleged complex proprietary compounds of undefined composition. All are effective to a degree, depending on the quality of the concrete, the workmanship in its placing, and the thickness of the concrete section. The weakness in all of them is that their effectiveness depends on having the concrete free from shrinkage cracks, a condition possible only in relatively small areas. Once integrally waterproofed concrete has been placed, something further must be done to correct a failure to secure the required impermeability or to eliminate leaks through shrinkage cracks.

Membrane waterproofing, theoretically the perfect method, provides a continuous self-healing barrier against the passage of water. It will ordinarily bridge minor shrinkage cracks and is independent of the quality of the concrete on which it is placed. The application of membrane waterproofing, however, presents some problems and its theoretical effectiveness is too frequently not attained.

Mr. Swanson advises the use of a fabric for waterproofing membranes (in a chapter of Hool and Kinney's *Foundations, Abutments and Footings*). He is probably referring to an open-mesh cotton fabric saturated with bitumen. Specifications for this fabric generally require a high tensile strength. It is probable that any organic fabric or felt will deteriorate to such a degree that it will have practically no tensile strength. Therefore, the bridging action of the membrane is dependent upon the elasticity and self-healing properties of the bitumen.

Manufacturers of waterproofing fabrics offer asbestos felts, which have been on the market for many years. It can be assumed these will resist the deterioration observed in organic fabrics and felts. Glass-fiber fabrics for waterproofing have come on the market recently. They likewise should have a long life. Whether the asbestos felts and the glass fiber felts or fabrics have sufficient elasticity to bridge cracks to the degree that the organic fabrics and felts do in the early life of a building, is a question. Good protection is most essential in the early life of the building when the shrinkage cracks are more likely to develop. The selection of the proper membrane waterproofing fabric is, therefore, one to be answered by the designer according to his own best judgment and experience and without much, if any, factual data.

The literature on this subject makes reference indiscriminately to asphalt and coal-tar pitch and various fabrics saturated with them. Waterproofed structures that have been remodeled or razed have brought to light some factors that might guide engineers in specifying membrane waterproofing materials.

A sidewalk over a basement was waterproofed with an asphalt-saturated cotton fabric specified to have a high tensile strength. When this was examined several years later, the asphalt-saturated cotton fabric had entirely disintegrated and the asphalt had deteriorated to the point where it had practically no waterproofing properties. It resembled a clay and was dark colored, almost black. It is now generally recognized that coal-tar pitch has a longer life expectancy under constant exposure to water than does asphalt.

It is possible that the fabric, either coal-tar-saturated cotton or felt, has served its purpose once the membrane has been applied, and its ultimate deterioration is not a serious matter, since the coal-tar pitch itself is present and will block the passage of water through the membrane. Coal-tar pitch is also self-healing, whereas asphalt is not under some conditions in which it must serve as a waterproofing material. Structures waterproofed with coal-tar pitch and fabrics have been in service for many years. Failures of coal-tar waterproofing have not been traceable to deterioration of the pitch. In consideration of these factors, it appears that coal-tar pitch is the preferred bituminous material for membrane waterproofing.

Membrane waterproofing must be protected immediately after placing, regardless of its location. When used on the outside of concrete walls, the classical method is to lay a course of brick outside the membrane. How to anchor this brick veneer without piercing the membrane is one of the problems. Another method is to apply a mortar coat over the membrane. This is not self-supporting, and in warm weather may cause the membrane to sag before backfilling is completed.

Membrane waterproofing of concrete floors is usually protected by a mortar

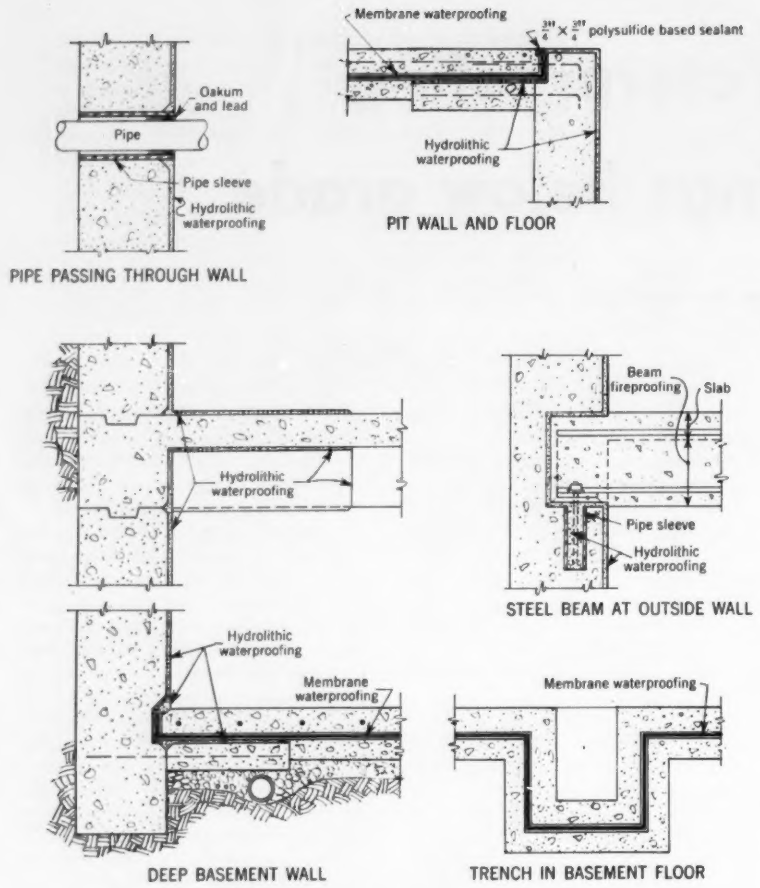


FIG. 1. A combination of hydrolithic and membrane waterproofing is used to keep a deep basement dry.

of portland cement and sand. Frequently this must be strong enough to take construction traffic before the structural slab is placed.

A bitumen-saturated protective boarding that has recently become available appears to be an ideal material for the protection of membrane waterproofing on walls and floor slabs. It it held in position by mopped-on bitumen.

Hydrolithic waterproofing, also referred to as the "iron method" or by proprietary names such as "Ironite," has advantages—and presents problems. The advantage of the hydolithic method over the other two is that the waterproofing is generally applied to surfaces that are accessible for repair throughout the life of the building. It has been used successfully to waterproof walls against a hydrostatic head of 70 ft—more than subbasement walls are usually designed to resist structurally. Therefore it is generally acceptable for almost any situation involved in deep-basement waterproofing.

The exceptions to this generalization occur when hydrolithically waterproofed surfaces must be covered with some finishing material or in the case of floors that may be subject to hydrostatic pressure. It is desirable to delay applying hydrolithic waterproofing as long as possible after the concrete has been placed. This allows more movement from settlement and shrinkage to take place before the waterproofing is done. The method will permit the repair of shrinkage cracks and honeycombing before the waterproofing is applied. Even then, continued shrinkage of concrete over a period of a year or two will result in further cracking. This can be repaired simply and inexpensively if the waterproofed surface has received no finishing material.

Shrinkage cracks are almost certain to develop in concrete floor slabs on any subgrade, with or without shrinkage control joints and regardless of the amount of reinforcement in the slab. Cracks will extend through a hydrolithic waterproofed surface on the floor. If there is no floor covering, they can be cut out and repaired when they develop. However, this procedure is objectionable since it involves the moving of equipment or materials that may be stored on the floors when the leaks develop.

It is generally possible to delay the application of finishing materials over hydrolithically waterproofed exterior walls until most of the shrinkage cracks have developed and can be cut out and filled. Cracks in the hydrolithic waterproofing, which develop after it is necessary to apply the interior wall finish, may be of such size that autogenous healing will take place, since the amount of moisture moving through such minor cracks is small in amount. Ventilated furring over hydrolithically waterproofed exterior walls under these conditions is generally successful and should be provided, regardless of how the wall is waterproofed.

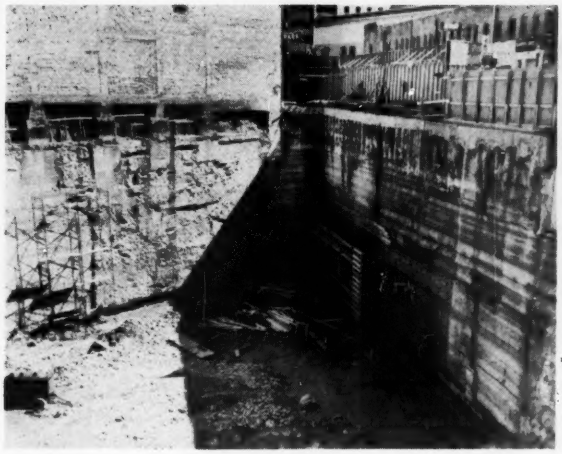
In some cases, the application of membrane waterproofing to the exterior of the wall is practicable and economical. It would be a more desirable method than the hydrolithic, except that if a leak develops in the exterior membrane waterproofing, it is difficult to find and it is expensive if not impossible to repair, since it may not be accessible.

A logical conclusion to be drawn from the above analysis is that the hydrolithic method should be used where it is more effective, that is, on exterior walls where the membrane method is not practicable, and that the membrane method should be used where it can be most easily applied and is most effective, that is, on floors.

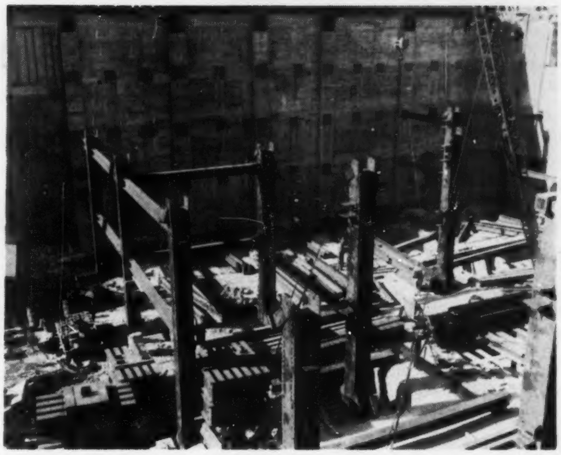
Methods of construction

It is desirable to have a finished concrete floor at the lowest basement level at an early stage of the construction work. It should be a dry floor. This can be accomplished by laying a plain concrete slab of sufficient thickness to provide a satisfactory base for receiving the membrane waterproofing. The structural slab can then be placed, pitched toward permanent floor drains.

Waterproofing of vertical surfaces should be delayed as long as practicable to permit the location of leakage areas through honeycomb, shrinkage cracks, or unsound concrete, and at the junction of floor slabs with exterior walls and interior columns. Leaks through the walls, in sufficient amounts to be objectionable, can be spot waterproofed by the hydrolithic method at the leaks only, the overall waterproof-



Drilled concrete piles, close together, cut off nearly all ground water. Recesses cut in the rock, channel water to a sump, from which it will be pumped during the life of the building.



Hydrolithically waterproofed pockets in far wall are ready to receive steel beams. Since these walls have no membrane on the outside, they were anchored to the rock.

ing being postponed until the walls have set, shrunk, and developed their shrinkage cracks. If necessary, water can be prevented from coming in at the periphery of the columns and at the junction of the floor slab and the exterior walls—by drainage and by bleeding the area outside the building walls and under the floor and removing the water by temporary pumping equipment or by permanent sump pumps.

If the exterior walls can be carried below the basement floor in rock or impervious soil, only a small amount of water will find its way under and around them. This water can be economically removed by an under-floor drainage system discharging to a sump, whence it can be pumped to the sewer throughout the life of the building. This eliminates the necessity of designing the floor for a hydrostatic head.

If seepage water is excessive and it would not be economical to pump it for the life of the building, the floor slab can be designed to resist movement under the maximum hydrostatic head. The under-floor drainage system, however, should be kept in operation until the structural slab has attained its designed strength, and the greater part of the shrinkage in the floor has developed. Then the junction of the membrane waterproofing of the floor and the hydrolithic waterproofing of the wall can be completed and the discharge to the sump of the under-floor drainage system can be plugged. As the hydrostatic head develops, following the plugging of the under-floor drainage system, leaks will probably develop in weak places at the junction of the membrane waterproofing of the floor and the hydrolithic waterproofing of the walls. The under-floor system can again be opened up and drained to the sump, and weak points repaired.

If there is only a small amount of ground water outside the building, but it is at such an elevation as to produce a relatively high hydrostatic head, it may be economical to bleed off this water through vertical and horizontal French drains on the outside of the wall and pump it for the life of the building, instead of designing the exterior walls for the hydrostatic head. If the volume of ground water is large and pumping is not economical compared with the cost of designing the walls for the full hydrostatic head, then French drains should be installed vertically and horizontally outside the walls. If the amount of water coming through the concrete walls is sufficient to require bleeding at shrinkage cracks and porous spots in the wall for the relatively short period necessary to waterproof such areas, the French drains can be bled to the sump temporarily to facilitate the application of hydrolithic waterproofing.

Interior concrete columns are exposed to the passage of water upward from the subgrade through the footing. The same objections apply to the installation of membrane waterproofing between the column and the footing as do to the carrying of the membrane waterproofing across the top of the exterior wall footing. Therefore columns should be treated like exterior walls and waterproofed by the hydrolithic method to some distance above the basement floor, depending on the permeability of the concrete, the hydrostatic head, and similar factors. Generally 3 ft is adequate.

In multistory basements, where structural steel beams and girders are required to frame into reinforced concrete basement walls, pockets should be formed in the wall and waterproofed by the hydrolithic method to subsequently receive the steel. This is not so necessary in the case of reinforced concrete beams and slabs, which normally are poured integrally with the basement wall. Shrinkage of the concrete usually results in an imperfect bond on the under side of the bars in deep slabs and beams, which also affords a path for water penetrating the wall to follow along the beams inside the building. Likewise these beams and slabs should be waterproofed by the hydrolithic method on the top and bottom of the slab and around the beam for a distance from the basement wall depending on the density of the concrete and the hydrostatic head. Examples of waterproofing procedures discussed above are shown graphically in Fig. 1.

Bibliography

DiStasio, Joseph D. and Fishburn, C. C., "Job Problems and Practice," ACI *Journal*, Feb. 1944, p. 323. (Applying membrane waterproofing to plain concrete wall footings.)

Fishburn, Cyrus C., "Prevention of Dampness in Basements," *Proc.* ACI 44: 421 (*Journal*, Feb. 1948).

Hool and Kinney, *Foundations, Abutments and Footings*, p. 272, McGraw-Hill Book Co., Inc., New York, 1923.

Jumper, C. H., "Tests of Integral and Surface Waterproofings for Concrete," *Proc.* ACI, 28:209.

Seelye, Elwyn, *Data Book for Civil Engineers*, Vol. 2, *Specifications and Costs*, John Wiley & Sons, Inc., New York, 3rd ed., pp. 3-40, 3-42.

Seelye, Elwyn, "Waterproofing for Concrete and Masonry," *Architectural Record*, March 1958, p. 235.

Small, Ben John, "Specifications for Waterproofing," *Progressive Architecture*, Aug. 1953, p. 101.

Washa, George W., "The Efficiency of Surface Treatment on the Permeability of Concrete," *Proc.* ACI, 30:1 (*Journal*, Sept.-Oct. 1933).

Special facilities for painting Air Force planes

provided in

long-span prestressed-concrete hangar

Construction of a hangar for the cleaning and painting of military aircraft at Hill Air Force Base in Utah presented a variety of problems, including long spans, personnel health and safety, and a limited budget. Studies indicated the need for two areas, one for cleaning and one for painting, each 130 ft square and 38 ft in clear height, with air-tight doors separating the two. A comparison of many structural systems led to the choice of a rigid-concrete-frame structure with precast prestressed girders, the first such structure to be specified by a government agency and including the longest precast-prestressed members erected in the United States at that time.

One unusual feature of the design was the chosen ventilation system which utilizes the hangar as a low-velocity duct and determined the shape and structural details of the hangar. Since it is generally found difficult to enforce the use of respirators by painting personnel, the decision was reached to adopt design criteria that would make the use of such equipment unnecessary. Controlled air conditioning produced best painting results and full compliance with health and safety requirements.

Conferences were held with Air Force Medical Officers and inspections were made of existing Air Force installations as well as of civilian painting and cleaning facilities. Three major design requirements resulted:

1. Concentration of toxic fumes below 200 ppm
2. Minimum velocity of air movement of 100 fpm
3. Operating temperature of 72 deg F

To meet these requirements, two major systems of ventilation were considered: (1) a "down-draft system" introducing conditioned air at the ceiling and exhausting contaminated air through a series of tunnels below the floor; and (2) a "side-draft system" introducing the air at one side and exhausting it at the opposite side.

Both systems would employ similar air-conditioning equipment and water wash sprays for removal of entrained lacquer pigments and some of the solvents, which may be soluble in water. With proper orientation of the working force with respect to the aircraft, such that the air flow carries the contaminated air away from the worker, either system is feasible. Studies showed, however, that the downdraft system would require three times as many air changes as the side-draft system to satisfy the basic criteria—an air change every 25 seconds as against every 75 seconds. This together with the expense of the under-floor tunnels for the downdraft system, which would have to carry heavy aircraft wheel loads, dictated the choice of the side-draft system.

With this decision made, it was possible to proceed with detailed structural design. The ventilation system required a hangar structure of 130-ft clear span, 260 ft long, with a horizontal smooth ceiling which would not disturb the air flow. The mechanical equipment required a 32-ft column spacing. A structure of substantial character was desired. Consideration was given to earthquake and wind forces consistent with the hangar's location in the Great Salt Lake Basin. The cost was limited by a strictly enforced budget.

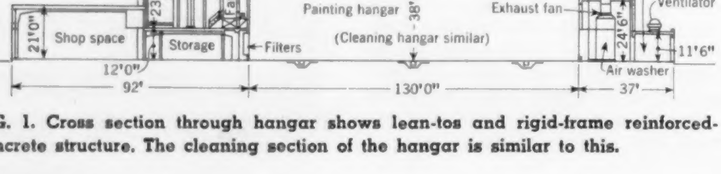


FIG. 1. Cross section through hangar shows lean-tos and rigid-frame reinforced-concrete structure. The cleaning section of the hangar is similar to this.

Cost estimates of several roof systems were compared:

1. Precast-prestressed concrete barrel shells with a suspended ceiling
2. Precast-prestressed concrete girders with precast ribbed roof slabs bearing on the bottom flanges of the girders
3. Similar to the above, but with girders made continuous with concrete columns to form a rigid frame
4. Precast three-hinged concrete frame with precast ribbed roof slabs
5. Structural steel trusses and steel deck roof, with a hung ceiling
6. Laminated wood arch on concrete A-frame columns, with a hung ceiling
7. Laminated wood arch on concrete cantilever frames, with a hung ceiling

The cost estimates indicated that all these systems were competitive; for various reasons, the selection was narrowed down to Types 2 and 5, the lowest in first cost.

Type 2A, a modification of Type 2, was also considered. This had the precast ribbed roof slabs above the girders, thus eliminating drainage and roofing problems, but required a hung ceiling. The steel truss roof was found to be lower in first cost than Type 2A, but the difference was less than 1 percent of the cost of the hangar. It was decided to use precast prestressed girders, with precast roof slabs above and a suspended ceiling below the girders (Type 2A). The decision was based on the lower maintenance cost and greater fire resistance of a reinforced concrete structure.

This basic structural system (Fig. 1) lent itself well to the use of a hung ceiling. Acoustical asbestos plaster on metal lath was supported by furring channels; these in turn were carried by steel channels attached to the girders. Hi-bay lighting fixtures were installed above tempered glass panels flush with the ceiling; this saved the cost of expensive explosion-proof fixtures. A system of catwalks was installed above the ceiling to service the lights as well as the sprinklers and other piping.

Foundations were originally designed for a soil with a bearing pressure of $2\frac{1}{2}$ tons per sq ft. The building is in an area that was once part of the Great

ANTON TEDESKO, M. ASCE, Vice President, Roberts and Schaefer Co., Consulting Engineers, Chicago and New York

LOUIS A. NEES, M.ASCE, Chief, Engineering Division

MARVIN T. KOERNER, Chief, Engineering Branch

Office of the Installation Engineer, Headquarters, Air Materiel Command, U.S. Air Force

Salt Lake and the soil was found to be an irregular alluvial deposit of sand, gravel, silt and clay. Therefore, to assure uniform bearing values, it was decided to remove 12 ft of material below finished grade and to replace it in 6-in. layers and compact it to 95 percent modified Proctor density. Differential settlement was thus held to a minimum.

The "split level" leanto (Fig. 1) was designed as a reinforced-concrete rigid frame subject to earthquake forces (Zone 2), a 100-mph wind, as well as static loads. Metal-pan-formed joists span between frames. This leanto is completely separated from the hangar by proper joints, while the leantos housing the water-wash systems and exhaust fans are built integrally with the hangar columns.

Walls were constructed of concrete block, reinforced for earthquake forces. Dowels for wall reinforcing were placed in soffits, spandrels and grade beams. Longitudinally jointed blocks were used where blocks had to be placed around reinforcing.

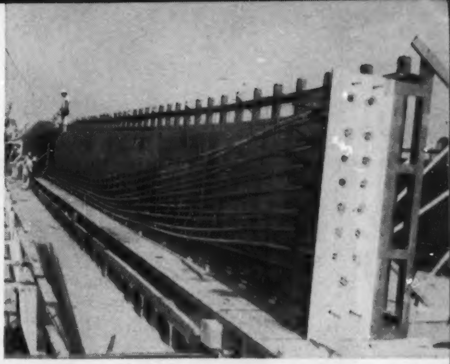
The design of the structural frame of the hangar was controlled by two major factors in addition to the dimensional restrictions. These were, first, earthquake and wind forces requiring the girder and columns to act as a rigid frame; and second, economy which dictated that the girders and roof framing be precast, thus reducing form cost and eliminating scaffolding.

With these requirements, it was necessary to develop in detail the sequence of construction before the actual design could be completed. The final design was, therefore, based on the following order of construction:

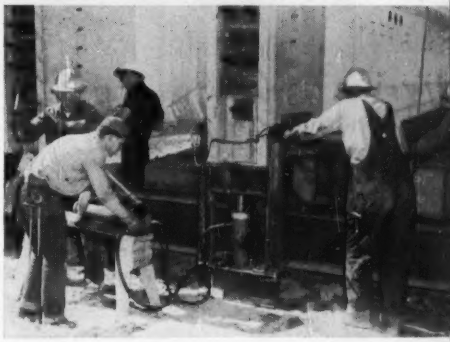
1. Concrete girders (84-ton, 136 ft long) and concrete roof panels (6-ton, 29 ft long) were precast on the ground at the site.
2. The girders (Fig. 2) were post-tensioned with 65 percent of their total prestressing force. This partial stressing was an important requirement. Because of the long span and wide column spacing, each girder had to carry over 350 tons of load, of which only 84 tons is the dead load of the girder. The total stressing force had to resist this high load. The most critical loading condition occurs when the initial post-tensioning force is counteracted only by the girder dead load. If the total stressing force had been applied initially on the girder section, the stresses would have been excessive, or it would have been necessary to increase the girder cross-section solely to take stresses during erection. This would have increased girder cost and made the erection of the girders more difficult. For this reason, the method of two-stage post-tensioning was utilized.
3. After Stage 1 post-tensioning, the girders were lifted up 40 ft into place onto the cast-in-place columns.
4. The precast roof panels were erected on the girders.
5. With the additional load of the roof panels, the girders were then post-tensioned with the remaining 35 percent of the stressing force.
6. Finally, concrete was cast in place between the roof panels and the girders, and between the girders and the columns. When these cast-in-place joints had attained design strength, the structure became a monolithic frame, tied together from roof panels to footings, and designed to resist the subsequent loads—snow, wind, earthquake, cranes, hung ceiling, and movements caused by temperature changes and footing settlements.

Design of the girder itself involves two phases:

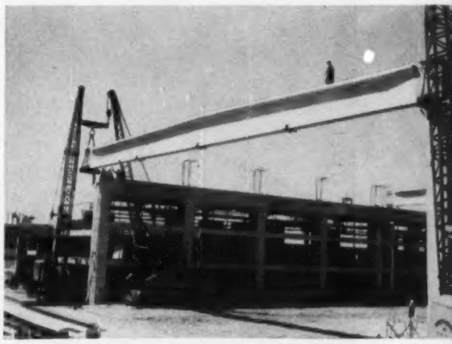
1. The girder is first loaded as a simple beam with only the precast cross-section resisting the loads.
2. After the slab band and knee joints have been cast, the girder is part



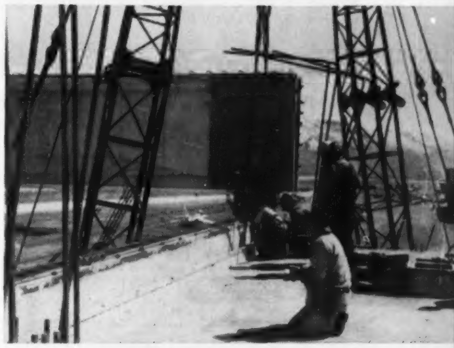
1



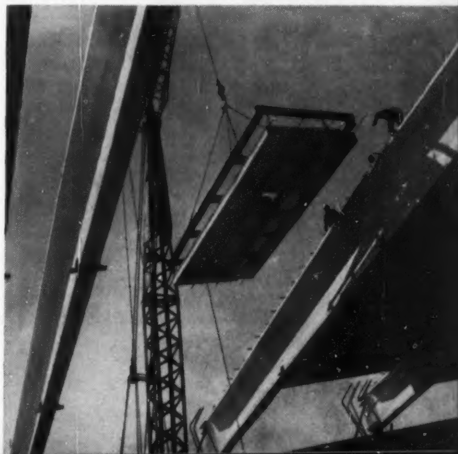
2



3

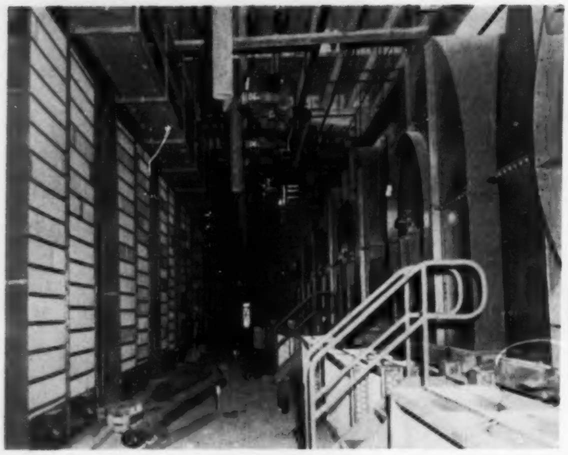


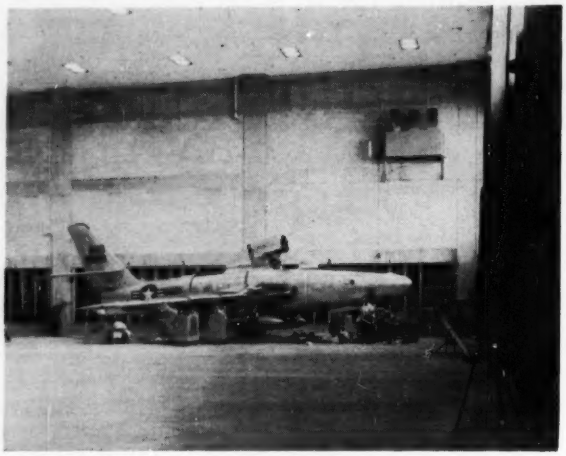
4



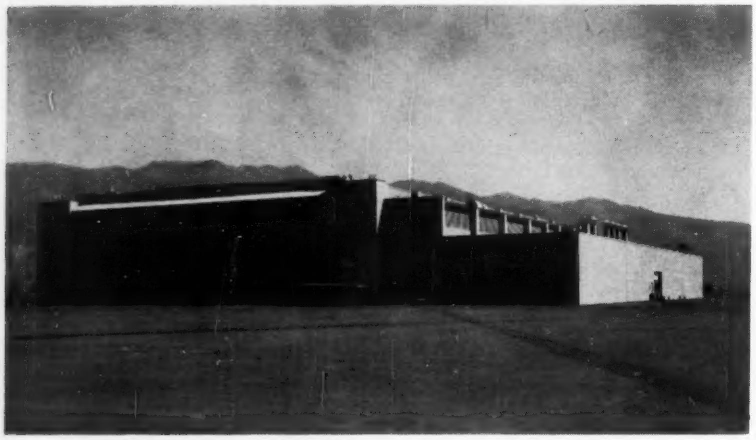
5

(1) Stressteel strands are draped in wood forms; when strands are tensioned after concrete is cast, the center of the beam deflects upward and thus becomes end supported. (2) End of girder is being jacked up so that handling dolly can be attached. (3) Girder has been lifted from storage area, left foreground, and is being set on rails. (4) Eighty-four-ton girder is pulled along top of structure to final position. (5) Precast roof panels, 25 × 11 ft in area, were placed with a metal lifting frame.





Machine rooms occupy lean-to of Cleaning and Painting Hangar. Sliding air-tight doors, at right, and smooth ceiling with recessed explosion-proof lights are features of the hangar.



Hangar at Hill Air Force Base in Utah is a complete facility for cleaning and painting of aircraft, especially developed for safe handling of toxic and explosive vapors.

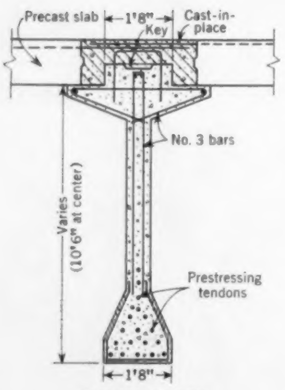
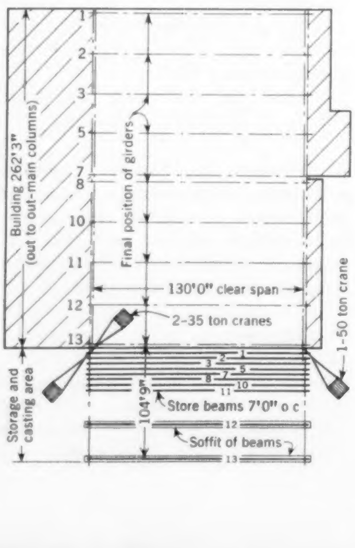


FIG. 2. Section shows location of Stressteel strands at center.



of a rigid frame. The composite section of girder, slab band, and roof panels resists the loads like a large T-beam.

Specifications called for the use of 5,000-psi concrete (4,000-psi at the time of initial tensioning) and left the choice of the prestressing system to the contractor. The drawings called for prestressing tendons, which could consist of wires, strands or high-tension bars. The contractor chose to use high-tension steel of $1\frac{1}{8}$-in. diameter, with a minimum yield point of 130,000 psi. The permissible initial tension was 95,000 psi. Bars were threaded at the ends and at couplers.

The method of construction followed the sequence set up in the design. The contractor arranged his casting yard beyond the hangar area, where he built concrete footings in continuation of the line of hangar columns. On these he placed wide-flange steel beams. Each girder was cast in the yard, parallel to its final position in the hangar structure (Fig. 3). After the concrete had attained the required strength, and the initial prestress was established by post-tensioning, the girder would deflect upwards and, supported solely at its ends, it would be jacked up, put on dollies, and moved along the wide-flange beams into storage position adjacent to the hangar until time for erection.

Side forms, constructed of plywood for two girders at a time, were held

FIG. 3. Schematic plan shows how casting yard was arranged so that girders could be precast parallel to and near their final positions in the structure. The division between the cleaning and painting sections of the hangar is at the expansion joint between column lines 7 and 8.

rigidly in place by steel frames. Casting proceeded from the center of the girders towards the ends. An external vibrator on each side of the form was moved along to follow the placement of concrete.

The main girders contain 18 Stressteel bars of $1\frac{1}{8}$-in. diameter, of which 11 were fully stressed during the first stage. The girders at hangar doors, taking the load from only half a roof bay, have 15 bars, of which 10 were stressed initially. The initial post-tensioning of one girder took about 7 hours; the stressing force was kept equal at both ends.

The girders were lifted onto the last pair of hangar columns by means of one 50-ton crane at one end, and two 35-ton cranes at the other. It required 5 minutes to raise one girder and about 15 minutes to set its ends on rails fastened to the high spandrel beams near the tops of the columns. See Fig. 4. The girder ends were then winched laterally along the rails to their final position. This took about $2\frac{1}{2}$ hours per girder; each girder was then lowered into place. Before erection of bracing or of precast roof panels, the girders happened to be subjected to a 75-mph wind. No distress was noted, although the girders deflected laterally about $1\frac{1}{2}$ in. Lateral deflections were also noted while the girders were gaining strength in the casting yard; these were due to daily warming by the sun, which hit the girders from the east in the morning.

While the girders were being built, the roof panels were being precast in two concrete molds at the rate of one 29- by 11-ft panel each day. Three rows of bracing with 3-in. by 4-in. angles were connected between the bottom flanges of the girders. This prevented lateral rotation of girders under unsymmetrical application of the load of the roof panels. A metal frame used in lifting the roof panels onto the girders was connected at the four corners of the panels through inserts.

Three weeks after the roof panels were erected, the remaining bars of the prestressed girders were tensioned. At this time, the high-tensile-steel bars in two of the girders were tested for stress losses; the jacks at each end were engaged and pulled until the shims behind one nut came loose; the stress on the jack gages was then read and the bars were pulled until the gage reading indicated that the full initial force had been recovered.

Bars stressed in Stage 1 required an average of $\frac{1}{2}$-in. total additional elongation to recover initial stress, and bars stressed in Stage 2 required an average of $\frac{5}{16}$ in. This indicated a loss of 7,700 psi in Stage 1 steel (an 8-percent loss) and of 4,800 psi in Stage 2 steel (a 5-percent loss). From the jack reading as the shims came loose, an average steel stress of 85,000 psi was obtained, indicating an average loss of $7\frac{1}{2}$ percent as compared with a total loss of 16 percent assumed by the design.

Two weeks after final post-tensioning, the metal tubes containing the Stressteel bars were grouted, using a mix of 1 sack of cement, 1 teaspoon of aluminate powder, 2 oz of Plastiment, and 5 gal of water. Three girders were grouted per day, or about 50 bars of 136-ft length.

After all the girders and roof panels had been erected, reinforcing bars were welded to dowels from the tops of columns, which were bent into the slab band above the girders. When all the prestressing bars had been grouted, the column knee joints were cast and the concrete for the slab bands between the roof panels above the top flanges of the girders was placed so that the entire structural system became one monolithic unit.

At the time the design was prepared, nothing of this magnitude in prestressed precast concrete for buildings had been tried in the United States. The designers had to have a certain amount of faith in the ability of a contractor to surmount the problems involved. The manner in which the contractor met these problems fully justified the faith of the U.S. Air Force and of the designers in the potentialities of prestressed concrete in American practice.

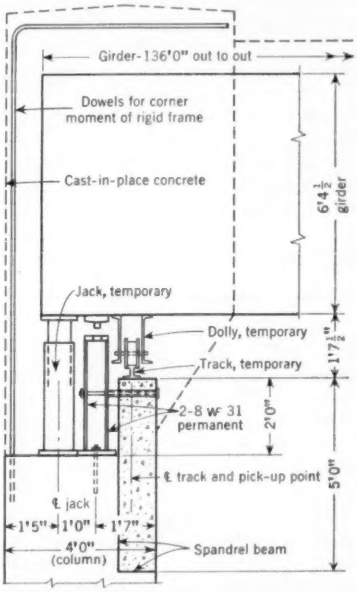


FIG. 4. After being raised to tops of columns, each girder was transported on temporary track and dollies to final position in the structure.

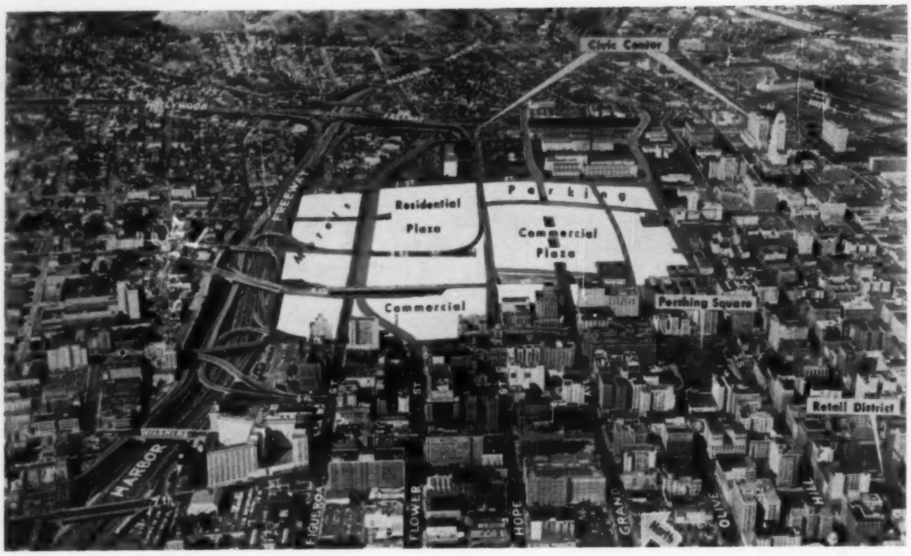
The ventilation system furnishes a flow of about 500,000 cfm of air through each half of the hangar. An additional 169,000 cfm is furnished to the shop area. The hangar air is drawn in over the roof of the shop area through a battery of automatic viscous-type filters, heated, and passed horizontally across the hangar floor. It is exhausted through a series of water scrubbers and cleanable filters. Positive pressure is maintained in the work area. The system in the cleaning area is similar except that water scrubbers are not used. Paint is filtered out of the exhaust air of the painting area by water-wash curtain units; the capacity of the system is 7,000 gpm. Water alkalinity is kept at approximately pH 10.5 to produce an easily removable pigment residue.

Steam is supplied by four 35,000-lb per hr package-type boilers constructed as an addition to the existing central plant at the Base. Fire protection is provided by deluge systems in the hangar area and by wet pipe sprinklers in the remainder. The hangar-floor drainage system is designed to carry off the entire sprinkler discharge without overflooding the floor and is equipped with gasoline separators and tanks to handle accidental spills.

Rolling-type hangar doors are provided at both ends of the hangar and as a fireproof dividing wall between the cleaning and painting areas. To prevent rail icing in cold weather, a hot-water radiant heating system is installed beneath the door tracks.

Electrical power is brought in from two sources at 6,900 volts. Two 1,000-kw transformers in a leanto serve the structure. Manual change-over to permit either transformer to serve the entire facility is provided. Distribution is at 480 volts. Electrical equipment in the hangar area is explosion proof. Hangar lighting consists of a combination of 400-watt mercury-vapor and 1,000-watt incandescent fixtures designed to furnish 40 to 50 ft-candles at floor level.

The $2\frac{1}{2}$-million-dollar facility was designed for the U.S. Air Force under the direction of the Engineering Division, Office of the Installation Engineer, Headquarters Air Materiel Command. The general contractor was the Jacobsen Construction Company of Salt Lake City. Construction was supervised by the San Francisco District of the Corps of Engineers, U.S. Army. Roberts and Schaefer Company were the architects and engineers for the entire project. Karsunky, Weller and Gooch served as mechanical engineer consultants to Roberts and Schaefer Company. The authors collaborated in exercising direction and supervision over the design.



The Los Angeles Community Redevelopment Agency is ready to begin development of the 136 acres in the Bunker Hill Urban Renewal Project, with proposed land uses as shown. Clearance of 400 obsolete structures will allow for the redevelopment of this area at the hub of the freeway system in downtown Los Angeles. Statler-Hilton Hotel, headquarters for the February 1959 ASCE Convention, appears at lower left.

The redevelopment of Bunker Hill in Los Angeles

The role of the Los Angeles Metropolitan Area in the economic, social, and cultural development of southern California and the western United States is becoming increasingly important. The heart of this metropolitan area is in downtown Los Angeles where clearance and rebuilding of blighted areas in the older sections is needed to prepare for the facilities required by government, business, and industry to gear themselves for the tasks of leadership ahead. Recognition of this need is evidenced by the strong, concerted backing of the Bunker Hill Urban Renewal Project by Mayor Norris Poulson, the Los Angeles City Council, and the Citizens Urban Renewal Advisory Committee (Irvan F. Mendenhall, M.ASCE, General Chairman), as well as by leaders of commerce and industry and the general public.

Why Bunker Hill?

The Bunker Hill Urban Renewal Project involves 136 acres of mixed residential and commercial obsolescence bounded generally by First, Hill, and Fifth Streets, and the Harbor Freeway. The project area has a hilly terrain that complicates traffic flow in the adjacent civic center on the north and the central business district on the east and south. Strategically located, the area is a logical starting point for the much-needed renaissance of downtown Los Angeles. The decay in this area is at the city's front door. "The Hill" has been a problem since the turn of the century, when the core of the city began to expand. Another important purpose of the project is to correct gross misuse of land and to eliminate economic stagnation and unproductiveness.

Existing conditions surveyed

This area varies in elevation from 303 ft above mean sea level at Fifth and Figueroa Streets to 417 ft at Second and Bunker Hill Avenue and is at or near the lower level on all sides except the northerly side. It includes a rounded hill running the length of the project.

Exhaustive studies and surveys were made of existing conditions in the area to determine without a doubt whether the project was eligible for redevelopment under all applicable law. The proof of eligibility was overwhelming and some of the highlights are worth noting. Most of the data that were utilized were obtained from surveys made jointly for the Community Redevelopment Agency by the City Planning and Health Departments of the City of Los Angeles by contract with the Agency. Funds for this work were advanced by the Urban Renewal Administration of the Housing and Home Finance Agency.

The Health Department work, under the supervision of Sanitary Division Director Charles L. Senn, M.ASCE, started with a survey in 1950 of all dwelling and rooming units (the principal difference between the two being in the kitchen facilities), using standards and techniques of the American Public Health Association (APHA). Since the planning of this large project extended over a period of several years, a resurvey of 10 percent of the units was conducted in 1955 to bring the 1950 data up to date. The APHA has four ratings for living units—acceptable, poor, substandard, and slum (or extreme)—depending on the number of penalty points. The basic items considered in penalty-point scoring are housing deficiencies that may adversely affect health, safety, or essential livability, neighborhood environment (traffic, to-

Included in the Bunker Hill Project will be a unique arrangement of parking structures beneath a pedestrian mall creating a park-like living and working environment for apartments and offices. Pereira & Luckman, supervising architects and engineers; Welton Becket & Associates, architects and engineers; Donald R. Warren Co., engineers.

WM. H. CLAIRE, M. ASCE, Assistant Executive Director, Community Redevelopment Agency, City of Los Angeles, Calif.

pography, noise, odor, mixed land use), and quality of housing. Basic deficiencies, another measurement of blight, include toilet facilities and sharing; bath type, location and sharing; deterioration; and water supply location. Some of the results of the APHA survey are shown in Table I.

The project contains 325 parcels of land with 395 buildings including 285 residential, 74 commercial, 31 accessory and 5 public. The Building and Safety Department of the City of Los Angeles made a survey of the structures in the project in 1957 and found that 60 percent were classified as dangerous and would require demolition.

The Bunker Hill area contains streets and alleys that are substandard in width, too steep, or that lead to dead ends. In this busy downtown location the streets lack adequate traffic-carrying capacity.

The residential population is 9,500 persons in 7,310 households. Only 130 persons live in property they own. There are 7,180 tenants. Single persons comprise 5,970 of the population. There are 980 families of two persons and 360 of 3 or more. Persons aged 65 and over include 1,900 single persons and 180 families. A total of 255 units house non-whites (mostly Filipinos). These facts and many more on family income, size, school needs, and the like are essential to formulate a logical and effective relocation plan. Relocation of site occupants is both a state and a federal requirement, the purpose of which is to prevent, wherever possible, their relocation in environments that are as bad or worse. Here is a golden opportunity to educate some of these people concerning the value of a decent residential neighborhood for their families.

The Police Department reported that arrests in the site area in 1957 were 88 per 1,000 population and for the same period the average for the city as a whole was 43. The Health Department reported in April 1958 that the ratio of tuberculosis cases per 100,000 population in the city was 84 and in the project area 423.

The assessed valuation of all privately owned property in the project area is approximately $5,015,720 and the annual tax revenue from this property is about $372,044. This amount is collected by the county and distributed to the city, county, Board of Education, County Flood Control District, and the Metropolitan Water District. The costs of city services exceed the tax revenue by a wide margin. A study of fire and police services, and part of the Health Department services shows an annual cost of $754,101 compared to a city tax return of $94,210.

The 10-percent housing survey made by the Health Department in 1955 showed a median annual family income of $1,600 to $2,000. The same survey revealed a median monthly rent of $30 to $40.

The California State Redevelopment Law requires that a preliminary plan be prepared by the City Planning Commission and a tentative plan and a redevelopment (final) plan by the Community Redevelopment Agency. Both plans must be approved by a City Council ordinance. The federal planning requirements at the time included a preliminary project report (corresponding to the state tentative plan) and a final project report. Since then the Urban Renewal Administration has changed its preliminary project report to an eligibility and relocation report and the project planning is logically centered on the final project report.

The City Planning Department prepared the preliminary plan for the project under the general supervision of the then Director of Planning Charles B. Bennett, and under the direct supervision of City Planner Tracy H. Abell. The City Planning Commission approved the plan early in 1955.

The next step in planning was the responsibility of the Redevelopment Agency under the Chairmanship of William T. Sesnon, Jr., who has held this position with a high civic purpose since the creation of the Agency in November 1948. The vice-chairman, Edward W. Carter, is president of the Broadway-Hale Department Stores of California; the treasurer, Dwight L. Clarke, is a retired president of Occidental Life Insurance Company; and the other members of the Agency are J. Howard Edgerton, president of the California Federal Savings and Loan Association and recently national president of the Savings and Loan League, and Allerton Jeffries, president of Jeffries Bank Note Company. With a group of experienced businessmen like this the success of the project is assured.

A survey and planning advance contract with the Housing and Home Finance Agency provided the funds (approximately $450,000) for the Redevelopment Agency's planning responsibilities. Expert local consulting talent was brought to bear on the studies required for the formulation of the tentative plan. For planning, architecture, and engineering the agency used an associa-

Buildings and additions to buildings such as these on Bunker Hill represent a fire hazard and should be cleared in the public interest.

A survey has revealed that less than 20 percent of the living units in the Bunker Hill project area are acceptable.

TABLE 1. Housing conditions on Bunker Hill

Summary of APHA survey results, in penalty points

	Facilities and Maintenance			Environment		
Classification	% of Total in 1950	Adjusted % of Total in 1955	% Change in 5 Yrs	% of Total in 1950	Adjusted % of Total in 1955	% Change in 5 Yrs
Dwelling units:						
Acceptable	18.4	18.3	− 0.1	4.2	2.5	− 1.7
Poor	17.4	19.9	+ 2.5	26.2	21.5	− 4.7
Substandard	23.0	22.2	− 0.8	25.3	39.2	+ 13.9
Extreme	41.2	39.6	− 1.6	44.3	36.8	− 7.5
Total	100.0	100.0	0	100.0	100.0	0
Rooming units:						
Acceptable	8.1	33.1	+ 25.0	2.7	2.7	0
Poor	35.2	20.2	− 15.0	18.0	0	− 18.0
Substandard	37.8	22.8	− 15.0	34.2	56.7	+ 22.5
Extreme	18.9	23.9	+ 5.0	45.1	40.6	− 4.5
Total	100.0	100.0	0	100.0	100.0	0

Basic Deficiencies

	Dwelling Units		
No Deficiency	20.6	21.7	+ 1.1
1 or more	79.4*	78.3*	− 1.1
2 or more	60.8	55.5	− 5.3
3 or more	35.4	20.4	− 15.0

* Note: When 75% or more of the dwelling and rooming units in an area have one or more basic deficiencies, rehabilitation is extremely difficult and demolition is usually indicated.

tion of three firms including Pereira and Luckman, Welton Beckèt and Associates, and the Donald R. Warren Company. For economic analyses and land marketability studies, the Agency contracted with land economist Henry A. Babcock and the Stanford Research Institute. Acquisition cost estimates were obtained by contract with the Bureau of Right-of-Way and Land of the Los Angeles Department of Public Works.

Public hearings were held by the Agency and the City Council on the tentative plan as required by law, and the Council approved the plan by ordinance in November 1956. Approval by the Urban Renewal Administration in the meantime permitted the final planning to start.

Final plan prepared

The consulting team for final planning included Pereira and Luckman, Donald R. Warren Company, and Homer Hoyt Associates, Washington, D. C., land economists, for a land reuse appraisal. Acquisition appraisals of each parcel were made by American Right-of-Way and Appraisal Contractors. A new group of consultants was brought onto the team to determine the salability of Agency bonds and included the law firm of O'Melveny & Myers as bond counsel and two financial consultants, Blyth & Company, Inc., and J. Barth & Company. In addition, the Agency availed itself of the consulting services of Joseph T. Bill while he was executive director of the Sacramento Redevelopment Agency on a part-time basis, until he took over full time as executive director of the Los Angeles Agency on January 1, 1958. His experience in successfully directing the Sacramento Capitol Mall Project enhances the value of his work for the Los Angeles redevelopment program.

The essential physical features of the Redevelopment Plan are land use, the street system, and the utility system. The gross 136-acre area contains 91 acres of land to be sold to private enterprise (after clearance and site improvement). About 40 acres is planned for a 1000-room hotel and 4 to 6 million sq ft of net rentable office space, two-thirds of which can be built in a commercial plaza with parking below a mall which will separate pedestrians and vehicles and set off the office buildings in a quiet park-like setting. This feature and others in the plan were developed by Architect William Pereira and his architectural assistants, Jack Bevash and Jack Campbell. Motels containing 2,000 units are proposed on 14 acres between the Harbor Freeway and Figueroa Street from First to Fourth Street. A 24-acre residential plaza will occupy the area bounded by

First, Hope, Fourth, and Figueroa, to contain 3,100 high-rise modern apartment units from which Bunker Hill and downtown employees can walk to work. It is proposed that the remaining 13 acres be used for multi-story parking structures generally located along the periphery of the project to serve both the new buildings in the project and the adjacent central business district and civic center.

The project street system has a dual objective—freedom of circulation of traffic to, within, and from the area, and alleviation of congestion in the adjacent downtown area by increasing the carrying capacity of the streets. These two objectives were effectively realized by using two modern street design principles wherever practicable—elimination of grade intersections and separation of vehicular and pedestrian traffic on two different levels. An artist's sketch of how the pedestrian mall in the Commercial Plaza might appear is shown in an accompanying illustration. In addition, the new street system will provide better access for all traffic to adjacent freeways through reduced street grades, widening, and realignment and by the elimination of intersections through the closing of substandard streets and alleys. Flower Street was rerouted to run parallel to Figueroa, and the two together act as a pair of one-way streets. This change also permits superblocks for the residential plaza.

The utility system was jointly developed by engineers of the City Water and Power Department, the Storm Drain Design Division of the City Bureau of Engineering, the City Bureau of Street Lighting, the Pacific Telephone and Telegraph Company, the Southern California Gas Company, the County Flood Control District, and the Donald R. Warren Company. Coordination of the utility layout for the Redevelopment Agency was expertly managed by Charles A. McMahon, M. ASCE, Acting Chief, Planning and Engineering Department of the Agency.

Controls and restrictions

Restrictions on development by private enterprise are twofold—existing city building code regulations and controls added by the Redevelopment Plan. Some of these controls are: (1) a maximum density of population in residential areas of 250 persons per acre, (2) a maximum land coverage of 40 percent for residential buildings, of 50 percent for main commercial buildings, and of 80 percent for other commercial buildings; and (3) a maximum height of eight stories for parking structures. Parking requirements are one space for each apartment dwelling unit, each hotel room, each motel unit, and each 400 sq ft of net rentable office area. All automobile parking and truck loading operations must be off-street.

Relocation plan

The carefully thought-out plan for the relocation of 9,500 persons includes the setting up of basic policies and an administrative organization, determining standards for relocation housing, and surveying the city for relocation housing resources. Of the 849,040 dwelling units in the entire City of Los Angeles, 37,970, or 4.5 percent, were vacant as of January 1, 1958, according to the City Planning Commission. There were 16,340 vacancies out of 349,877 dwelling units with an average monthly rent below $60. If the Bunker Hill relocation were spread over a three-year period, only 9 persons would have to move each day; that is, 7 dwelling units per day would be required. A federal grant of $750,000 has been approved for relocation assistance up to a maximum of $100 per family and $2,500 per business or institution for necessary moving costs.

The relocation operation is carried out by a qualified staff which assists displacees in finding a decent, safe, and sanitary place to live—a program unheard of in engineering works. The relocation program is good business for the community, means better living for the relocated family, and is conducted in an orderly, humanitarian manner. The Relocation Plan was formulated by the Agency's expert in this field, Miss Victoria Alonzo, Relocation Manager.

To carry out the project, the gross cost of which is estimated to be $65,549,691, the Agency will enter into a loan and grant contract with the United States Government under Title I of the Housing Act of 1949, as amended. This contract will provide for a Project Temporary Loan and a Project Capital Grant from the Federal Government and will require local grants-in-aid that may be cash or noncash. The Loan and Grant Contract will also provide for a Project Definitive Loan.

The Project Temporary Loan is estimated at $58,711,641, determined by adding to the gross project cost the amount of the relocation grant and then deducting the local one-third share of the net project cost described below. The obligations evidencing the Agency's indebtedness to the Federal Government for the Project Temporary Loan must be paid exclusively from moneys derived from the project and from the Project Capital Grant and will not be a debt of the City of Los Angeles, or of any of its political subdivisions.

The sale of land in the project area is expected to raise $42,785,000 of the gross project cost. The remainder, or net project cost, $22,764,691, will come from (1) a federal grant in aid in the amount of $15,176,461 (two-thirds of the net project cost), and (2) a local grant in aid of $7,588,230 (one-third of the net project cost).

The Agency tax allocation bond issue will be retired, including principal and interest, from the tax increase anticipated from the project, a provision in the State Redevelopment Law. The tax revenue increase is estimated to be $4 million annually. The bond issue, estimated to be in the neighborhood of $15,000,000, includes the local one-third share of the net project cost, payments in lieu of taxes during project development, and other costs necessary to the project such as bridges, pedestrian overpasses, utilities, special grading, and the like to guarantee the high order of planning and development such as separation of vehicular and pedestrian traffic and landscaping for a pleasant living and working environment. It is the opinion of the Agency's consultants that these costs will be absorbed in the enhanced value of the land for the purposes proposed.

Completion schedule

A project development period of four years is scheduled for the Redevelopment Agency to cover acquisition, relocation, demolition, site improvement (grading, streets, bridges, and utilities) and finally disposition of the cleared land by sale to private enterprise. The new owners of the land will need at least an additional two or three years to build their apartments, office buildings, and other structures. These four years will start when the Agency has entered into the Federal Loan and Grant contract and then marketed and sold the Agency bond issue. Federal approval of the loan and grants was obtained early in 1958. The Los Angeles Citizens Urban Renewal Advisory Committee has approved the Redevelopment Plan and concurred in the Relocation Plan.

The community generally is ready and eager for this necessary work. The metropolitan newspapers are strongly in favor of the project. As stated in the third chapter of Ecclesiastes, there is "a time to break down, and a time to build up." Both of those times have arrived for Bunker Hill. The obsolete structures have long since served their purpose, the outmoded street system needs complete reworking, the present site occupants need a healthier and happier living environment, and the whole city needs the fine, modern, efficient facilities proposed for the Bunker Hill Urban Renewal Project. It looks as though the city will soon get them.

A valuable combination—photogrammetry and electronic computation

JOHN H. MITCHELL, A.M. ASCE, Vice President, Lockwood, Kessler & Bartlett, Inc., Syosset, N. Y.

While the photogrammetric method of making topographic maps has become generally accepted as the basis for highway design, and electronic computations have to the best of my knowledge never been questioned as to accuracy—the total advantage that can be secured on highway projects by combining these two tools is rarely realized.

The reason for this lack of a coordinated application of these two techniques is twofold:

First, there are very few organizations in the country that are either concerned with, or have the facilities for performing all the following steps in a highway project: preliminary mapping, route study, final mapping, contract plans, and supervision of construction. Only rarely does any one organization actually perform more than two of these five steps.

For instance, a typical all-new interstate route to be constructed under the auspices of a state highway department might normally involve three separate organizations—not to mention the construction contractor, who builds the highway. Thus from the engineering point of view, the mapping, both preliminary and final, might be let to a photogrammetric firm. The route study might be done by one consulting firm, and another consultant might be engaged to prepare the final design or contract plans. Later on, perhaps, the state forces will supervise the construction.

Over the years, the scope of each of these functions has become well defined, and the transfer of certain standard forms of information such as maps and plans from one separate organization to another has enabled the project as a whole to proceed step by step. To effect the optimum interplay and utilization of photogrammetry and electronic computation, however, the design engineer must have necessary equipment at his disposal for adjustments and refinements throughout the design period.

To coordinate this interplay between several organizations performing what have heretofore been considered as separate functions would be virtually impossible. This then is the first reason why the maximum advantages have seldom been realized.

The second reason is somewhat less easily understood but from a practical viewpoint is just as valid. Let us suppose that on the same all-new interstate highway, one capable organization exists and is engaged to perform the entire series of functions previously named—preliminary mapping, route study, final mapping, final design, and supervision of construction. Assuming that this organization has the necessary qualified personnel as well as adequate photogrammetric and computing facilities, it still will probably be prevented from attaining maximum efficiency by the fairly inflexible requirement of most state highway departments for large-scale plotting of each cross-section.

It is the use of the two techniques of photogrammetry and electronic computation simultaneously for earthwork determinations that needs amplification, and it is the acceptance of the resulting forms of data instead of existing requirements that calls for special emphasis. Let us then fully examine what can be done today with these tools on a typical interstate project.

1. Route studies. When appropriate aerial photographs have been secured covering a given band of terrain between the termini of a project (usually about one-third as wide as it is long), a stereoscopic study of the photographs will determine in general the most feasible routes. With these routes projected on the photographs before their insertion in a stereoplotting instrument, the instrument operator can take spot elevation readings of the cross sections of each alternate route. The spacing of the sections and readings should be left to the discretion of the engineer, since this is for preliminary work only.

From this point forward, with photogrammetric data of the terrain at his disposal, and an electronic computer for quick calculations, the engineer can study many possible vertical and horizontal alignments with relative ease and consequently should arrive at very nearly the best earthwork solution.

This use of photogrammetry and electronic computation is only as an aid to the location engineer to be used if, as, and when he finds it necessary to investigate major alternatives from an earthwork point of view. It is of course likely that earthwork comparisons will be superfluous in highly developed areas where the predominant location factor will be land use. In any case, once a horizontal alignment has been selected for study, the electronic computer can provide the engineer with fast answers on earthwork quantities as he varies his vertical alignment.

2. Contract plans. With a general route determined as in Step 1 above, a lower flight should be made from which large-scale maps with a small contour interval can be made. Since these maps can be used as base maps on which to lay out the final design, it would seem prudent to compile the contour information at this time. As the narrowing-down process continues, innumerable minor adjustments in horizontal and vertical alignment can be examined in the computer, merely by introducing the new vertical alignment data with new cross-sectional data corresponding to the desired horizontal alignment. The terrain data can be taken either from the topographic map or by reinserting the photography into the stereoplotting instruments and taking direct spot-elevation readings across the superimposed alignment.

The type-out as it is generated from the computer is seen on the attached example, Fig. 1. It should be noted that programs have been written for both single and double roadways.

With this tabulated data, station by station, there is no need to plot each cross section, to template and planimeter the area, and then go through the average end-area computation. This is all done in the computer.

So we have the designed earthwork volumes without any cross-section plots. Why then is it necessary to plot the cross sections? When asked this question point blank, most highway departments answer that cross sections are needed to give the contractor and the

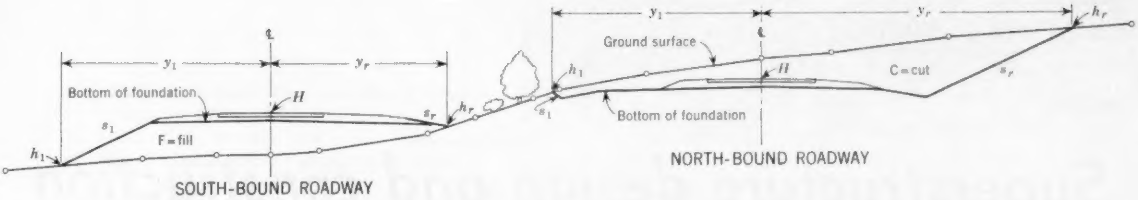


FIG. 1. Typical section, with reference dimensions shown, gives a good general visual idea of a highway project. Below are the earthwork computations, northbound, as they come from the computer.

Earthwork Computations , North Bound

Sta ft	H ft	S_l	y_l ft	h_l ft	S_r	y_r ft	h_r ft	C sq ft	F sq ft	C cu yd	F cu yd	F' cu yd	ΣC cu yd	ΣF' cu yd	ΣC+ΣF' cu yd
1484.00.0	1191.54	-4.00	54.0	1184.93	-4.00	39.8	1186.43		- 286		-	-			
1484.50.0	1191.65	-4.00	49.2	1186.25	-4.00	39.6	1186.60		- 244		- 491	- 491		- 491	- 491
1485.00.0	1191.76	-4.00	49.0	1186.41	-4.00	40.0	1186.60		- 256		- 464	- 464		- 955	- 955
1485.50.0	1191.87	-4.00	48.5	1186.64	-4.00	40.1	1186.70		- 240		- 459	- 459		- 1414	- 1414
1486.00.0	1191.99	-4.00	49.3	1186.55	-4.00	42.2	1186.29		- 287		- 489	- 488		- 1903	- 1903
1486.50.0	1192.11	-4.00	51.4	1186.16	-4.00	44.8	1185.75		- 336		- 579	- 578		- 2480	- 2480
1487.00.0	1192.27	-4.00	56.8	1184.95	-4.00	51.6	1184.21		- 502		- 776	- 776		- 3257	- 3256
1487.50.0	1192.47	-4.00	51.9	1186.38	-4.00	49.3	1185.00		- 400		- 835	- 835		- 4092	- 4092
1488.00.0	1192.70	-4.00	57.1	1185.31	-4.00	42.7	1186.87		- 404		- 744	- 744		- 4836	- 4836
1488.50.0	1192.95	-4.00	57.6	1185.45	-4.00	40.0	1187.80		- 355		- 703	- 703		- 5539	- 5539
1489.00.0	1193.20	-4.00	52.0	1187.10	-4.00	39.0	1188.30		- 260		- 569	- 569		- 6108	- 6108
1489.50.0	1193.45	-4.00	49.2	1188.05	-4.00	39.6	1188.40		- 249		- 471	- 471		- 6579	- 6579
1490.00.0	1193.70	-4.00	49.3	1188.26	-4.00	40.6	1188.40		- 264		- 475	- 475		- 7054	- 7053
1490.50.0	1193.95	-4.00	46.6	1189.18	-4.00	38.8	1189.10		- 215		- 443	- 443		- 7497	- 7496
1491.00.0	1194.20	2.00	45.3	1190.20	2.00	37.3	1190.20		- 154		- 341	- 341		- 7837	- 7837
1491.50.0	1194.45	2.00	46.4	1191.00	2.00	37.8	1190.70	3	- 114	3	- 248	- 247	4	- 8085	- 8081
1492.00.0	1194.70	2.00	47.7	1191.90	2.00	39.0	1191.51	11	- 71	13	- 171	- 171	16	- 8256	- 8240
1492.50.0	1194.95	2.00	48.1	1192.38	2.00	39.5	1192.02	14	- 54	23	- 116	- 116	39	- 8373	- 8333
1493.00.0	1195.20	2.00	49.3	1193.24	2.00	38.8	1191.91	17	- 58	29	- 104	- 104	69	- 8477	- 8408
1493.50.0	1195.45	2.00	49.7	1193.65	2.00	39.1	1192.32	22	- 34	37	- 86	- 86	105	- 8563	- 8457
1494.00.0	1195.70	2.00	50.1	1194.10	2.00	40.8	1193.41	32	- 17	51	- 47	- 47	156	- 8610	- 8454

supervisor of construction a visual "feel" as to what the job is to look like at each station.

I suggest that the attached exhibit (Fig. 1) gives a better visualization of a project in a nutshell than an armful of cross-section sheets. This exhibit includes the computer type-out sheet, as well as a typical section of the project with reference dimensions shown. For specific dimensions at any particular station, reference can easily be made to the tabulation, yet the sketch gives a good general visual idea. By merely running his eye down the slope column, the engineer can readily see where the section changes from cut to fill because there the slope changes from positive to negative.

3. Final pay quantities. Why, when an accurate topographic map has recently been prepared for a project should the resident engineer have to go out just ahead of the contractor and take preconstruction cross-sections in the field? If the photogrammetric survey was adequate for design purposes as well as for the engineer's estimate of quantities (on which the engineer was paid and the contractor made his bid), why is it not good enough as a starting datum for final pay quantities? It would seem that preconstruction cross-sections are superfluous.

And now we come to final pay quantities. If there is still any doubt in anyone's mind as to the reliability of photogrammetric results as opposed to field topography I leave that to be argued by my more competent associates. Since I have no doubts, I propose a fast aerial survey immediately after the completion of the project to provide the resident engineer with new and accurate measurements for presentation to both the owner and the contractor so as to insure fast and accurate payment for work done. The final photogrammetric cross-sections introduced into the electronic computer need only be set off against the original photogrammetric data to provide the total answer on the volume of earth moved. This figure, adjusted by interim field measurements for such items as topsoil stripping, stock-pile excavation, borrow-pit excavation, or excavation of rock or unsuitable material, should provide a quick and accurate pay basis.

So far I have avoided mention of the mechanical linkage between photogrammetry and electronic computing which is now on the design boards. This will provide a first-order stereoplotting instrument with a punched-paper-tape output. With such equipment, the x, y, and z coordinates of any point in a photogrammetric model will be recorded at the touch of a button in a form that can be directly inserted into an electronic computer. The purpose of this linkage is of course to reduce the time and effort necessary to obtain data in a useful form. The fact that such equipment is now being designed inspires confidence in the belief that a way will be found to take fullest advantage of the modern tools now placed at the disposal of the professional civil engineer. The ultimate development of these data-gathering and data-reduction procedures will naturally promote the use of electronic computation within photogrammetric organizations and perhaps will also promote the integration in design organizations of photogrammetry and electronic computation.

In any event the time is already here for the owner's representative to take a close look at his present requirements, and give thorough consideration to the acceptance in tabular form of some items that previously have been submitted in graphic form.

The new tools and techniques that have recently been developed and placed at the command of the civil engineer have in effect caused a technological revolution within the profession similar to that witnessed in many other fields in the past decade. If the potentials of these technological advances are to be fully realized, a concerted effort must be made to allow freedom and flexibility in procedures, specifications, and contracts for civil engineering work.

(This article was originally presented as a paper before a joint session of the Surveying and Mapping and Highway Divisions at the ASCE Annual Convention in New York.)

Superstructure design and construction

D. B. STEINMAN, M. ASCE, Consulting Engineer, New York, N. Y.

C. H. GRONQUIST, M. ASCE, Associate Engineer with D. B. Steinman, Consulting Engineer, New York, N. Y.

Mackinac Bridge has a length, out-to-out of anchorages, of 8,614 ft, the longest in the world. This length is made up of 3,800-ft main suspended span plus a 1,800-ft side span, a 472-ft backstay deck-truss span, and a 135-ft anchorage on each side.

To bridge the four-mile Straits of Mackinac has been a challenge to the engineer and to the public of the State of Michigan since the early eighties, when the railroad ferry service was first inaugurated. It is a project that over the intervening years has made a strong appeal to the minds and hearts of all, for it would open the relatively undeveloped, but potentially rich, Upper Peninsula of Michigan to make the two peninsulas of Michigan one.

But the depth of the water, the thickness of the ice, the shortness of the construction season, the force of the winds, and the high cost if the project were otherwise feasible, all made it a bridge that couldn't be built, it was said. Finally the press of traffic became such that it would support an investment sufficient to build and finance the bridge. A design that reflected the latest developments in the art of bridge building, together with advances in the science of aerodynamic stability, made the structure an economic possibility.

Completion of the five-mile-long project with its approaches in four short construction seasons was required to maintain minimum financing costs. This called for cooperation and coordination between the engineers and the contractors in both design and construction. It was made possible by the fact that bids were taken and contracts negotiated with the two principal foundation and superstructure contractors on well developed but preliminary plans, with final design plans to follow. Superior organization and execution of the work of all contractors, coupled with outstanding cooperation among the Mackinac Bridge Authority, the Engineer, and the other contractors, enabled the bridge to be opened to traffic November 1, 1957, the date set almost four years before.

Features of the design and foundation construction of the Mackinac Bridge have already been covered in a previous symposium published in Civil Engineering for May 1956, as follows:

"Designed for Complete Aerodynamic Stability," by D. B. Steinman.

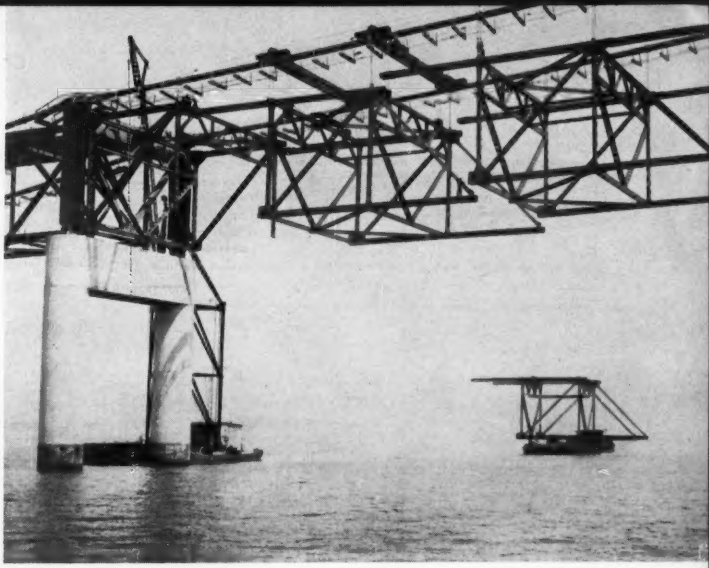
"Located with First-Order Precision," by G. Edwin Pidcock, M. ASCE.

"Foundations Constructed at Record Speed by Unusual Methods," by R. M. Boynton, Associate Engineer with D. B. Steinman, Consulting Engineer.

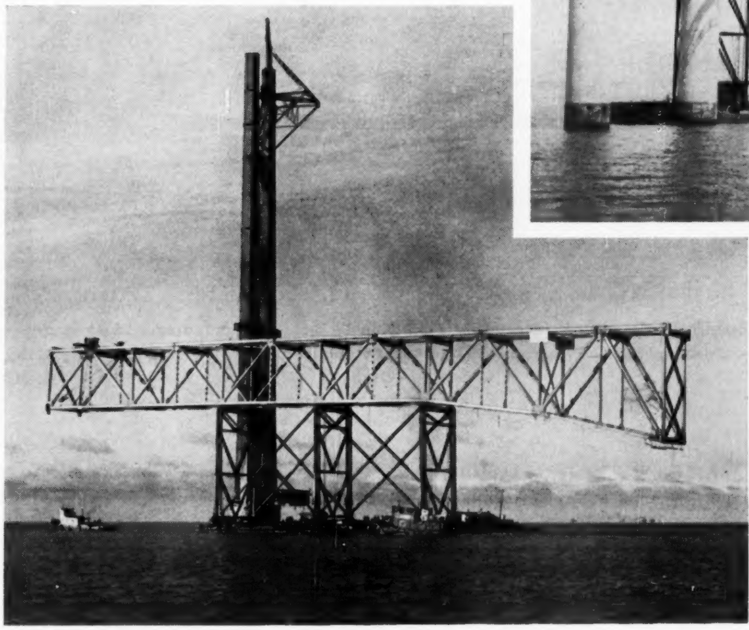
The three articles in the present symposium on the superstructure, cables, approaches, toll plaza and electrical work complete the description of the design and construction of the project.

The 3,800-ft main suspension span of the Mackinac Bridge is second in length to the 4,200-ft Golden Gate Bridge span, but the use of five cable spans with remote anchorages located for economy where rock is nearer the surface makes the 8,614-ft length between ends of anchorages the longest in the world.

The three suspended spans total 7,400 ft in length, also the world's greatest. They are flanked on each side by an independent 472-ft backstay deck-truss span between the 1,800-ft side span and the anchorage. In addi-



Stiffening trusses were assembled in units and hoisted into position. At left is the cable bent. Note that the end of the suspended span is supported by pinned vertical struts.



Backstay span of 472 ft was assembled on barges and floated into position between the anchorage and the cable bent.

tion, deck-truss spans total 5,691 ft for the 16 south approach spans and 3,608 ft for the 12 north approach spans. The total cost of 55,000 tons of structural steel together with that of the cable items, required for the superstructure, was almost $44 million, the largest bridge contract ever written.

Including the viaduct approaches in Mackinaw City on the south and on the causeway at St. Ignace on the north, the total length of steel is 19,-205 ft, about 3½ miles. The length over water, including the previously built causeway, is 4 miles, and the total length of the project from Straits Avenue in Mackinaw City to Route U. S. 2 in St. Ignace is 5 miles. The contract cost to the Mackinac Bridge Authority for the entire project is about $80 million, of a total financing of $100 million, including interest during construction. A maximum of 1,000 men were employed on construction work at the immediate site.

The deck of the bridge consists of two 23-ft roadways with a 2-ft mountable center mall and two 3-ft sidewalks, to give a total width between railings of 54 ft. The bridge is designed for H20-S16 truck and trailer loading, and for a wind pressure of 50 psf combined with dead load. On the approach spans the floor is a 6-in. reinforced-concrete slab with 1½ in. of bituminious concrete surfacing. For the suspension spans the floor is a steel grid.

The outer lanes are 4¼ in. in depth, filled with lightweight concrete and surfaced with bituminous concrete, while the two center lanes and the mall are of open grid to reduce weight and for aerodynamic reasons. The use of a steel-pipe handrail throughout, and of a 5-in. steel pipe curb on the suspension spans, is for aerodynamic reasons also, as well as to permit snow to blow off the bridge. On the truss spans it has been observed that snow stays on the roadway for a distance out from the curb equal to about twelve times the height of the 10-in. concrete curb guard.

The vertical clearance at normal temperature is 155 ft at the center of the main suspension span and 135 ft at the boundaries of the 3,000-ft navigation channel. Variations in temperature will produce a rise or fall at center of the main span amounting to nearly 7 ft, more than 1 in. per deg Fahrenheit.

The floor system on the suspended spans consists of 12-in. transverse cross beams, which support a steel-grating floor at 5-ft intervals on five lines of two-span continuous stringers of 30-in. silicon steel, spanning 39 ft between the 10-ft-deep floor trusses.

Ample vertical stiffness is provided by stiffening trusses that are 38 ft deep, 1/100th of the main span, and are 68 ft from center to center, or 1/56th of the main span. Torsional stiffness is provided by double systems of lateral bracing at the top and bottom chords of the stiffening trusses. The torsional frame, composed of the two lateral systems and the two vertical stiffening trusses, is stayed at each panel point with a sway frame.

The suspension bridge has been designed for a wind load of 50 psf on 1½ times the vertical projection, corresponding to a wind velocity of 115 mph, determined on the basis of wind-tunnel tests. Design stresses for a 50-psf wind are combined with dead load and temperature stresses with a 30 percent increase in basic unit stress. Design stresses for a 20-psf wind are combined with dead load, live load and temperature stresses with the same increase in unit stress. The suspended spans were designed for a live load of 2,000 lb per ft of span.

The stiffening-truss members are box sections with the angles turned in for aerodynamic reasons. Both top and bottom chords consist of four 4 × 4-in. angles, 22-in. web plates, an 18-in. top cover plate, and an 18-in. perforated bottom cover plate. The maximum

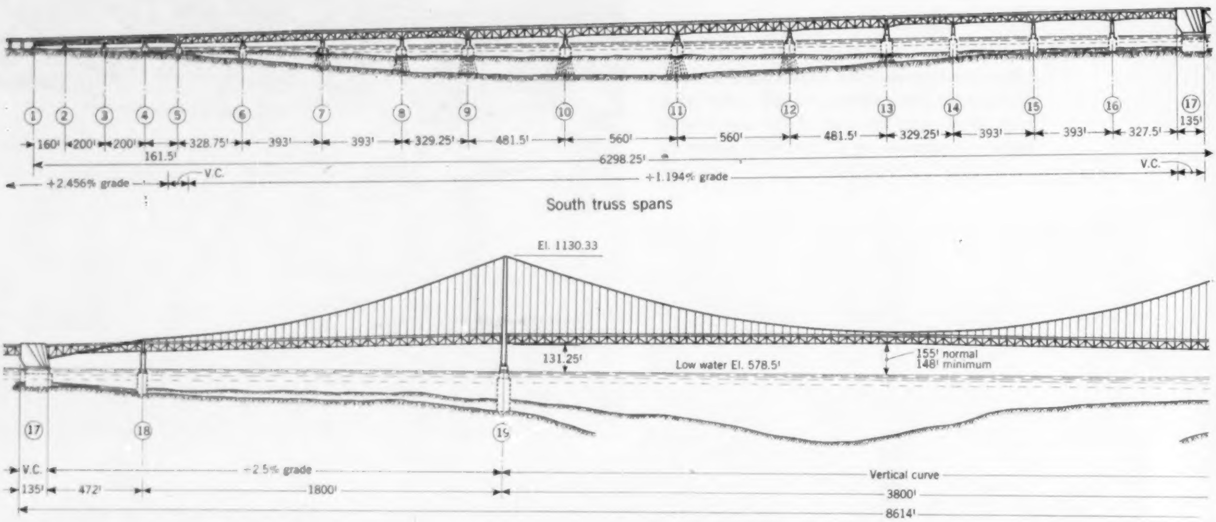


FIG. 1. Of the 33 water piers, 30 were built in open cofferdams and three (Piers 18, 19, and 20) in open-dredged caissons. Piles were used for Piers 7 to 13 inclusive, at the secondary gorge, where rock is very deep and covered with deep, relatively stiff

chord area is 114 sq in. of silicon steel, and the average chord area is 90 sq in. to give a Steinman stiffness constant of 80 for $n = 2$ (two segments). (See "Rigidity and Aerodynamic Stability of Suspension Bridges," by D. B. Steinman, ASCE *Transactions,* Vol. 110, 1946, p. 441.)

The web members are made up of 12-in. channels with 20-in. perforated cover plates, except for the heavier diagonals, where a full top cover plate is used. The laterals consist of two 12-in. channels turned out, with two 14-in. perforated cover plates. The lateral systems are tension-compression X-systems, designed to participate with the stiffening-truss chords to take live-load stress and contribute vertical stiffness to the structure.

Provisions for expansion

Because of the large expansion to be accommodated, it was found more practicable to support the end of the stiffening truss at the tower with the use of a 14-in. wide-flange link or hanger attached to a bracket on the tower. The link has double pin castings at both ends to permit freedom for rotation both longitudinally and laterally.

The main-tower roadway expansion joint is made up of 7-in. x 1½-in. finger bars 9 ft 7 in. long, assembled in units 21 in. wide. The finger bars lap to permit a motion at the curb line of about 3 ft in either direction on each side of the tower. Each 21-in. unit is pinned and singly bolted to permit horizontal rotation resulting from horizontal deflection of the spans due to lateral wind. The outer ends of the finger-bar unit are tied together by a hardened steel member which slides on the supporting beams. The fixed end of the finger-bar unit is connected to the end of a 10-ft-long section of filled steel-grating floor that acts much like a ferry transfer bridge to allow vertical angular deflection of the spans without sharp breaks in grade at the tower.

The stiffening trusses were designed to be fastened to the cables at the center of the main span by heavy plates which are pinned to the long center cable band to take traction force, longitudinal and transverse wind and torsional effects resulting from antisymmetrical live loading.

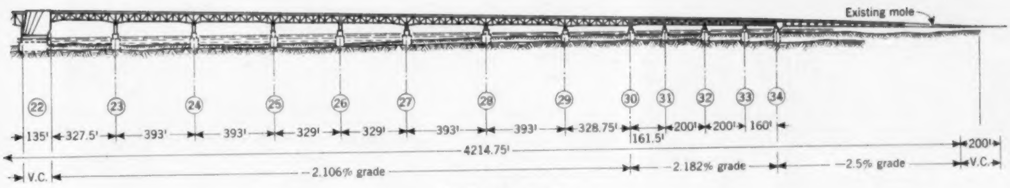
At the cable bent, at the shore end of the suspended side span, the stiffening truss is supported by a 14-in. wide-flange column pinned to a bracket attached to the bottom of the cable bent. The cable bent consists of two cellular columns 41 ft high, 6 ft 6 in. deep and 5 ft wide, which are braced by a 7-ft by 6-ft 6-in. box-girder strut at the top, a 2-ft 2-in. by 2-ft bottom strut and two similar diagonals of box section. A finger-type cantilever expansion joint is provided on each side of the cable bent, although on the suspension side span the only appreciable motion results from lateral wind. The asphalt-surfaced lightweight concrete floor rests directly on the top strut of the cable bent. The side span is tied to the cable-bent top strut at the top lateral bracing connection by a double pin casting which transmits the wind reaction of that point and permits vertical and lateral angular deflection of the long span.

The stiffening trusses were designed in accordance with "A Generalized Deflection Theory for Suspension Bridges," by D. B. Steinman (ASCE *Transactions,* Vol. 100, 1935). Load lengths for maximum moments and shears were determined using the influence-line procedure developed by Peery as given in ASCE *Transactions,* Vol. 121, 1956.

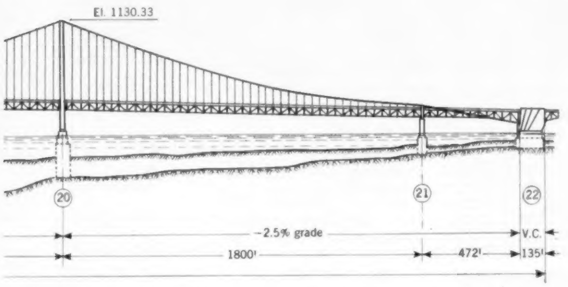
Wind stresses in the lateral systems and stiffening-truss chords were computed using the trigonometric series method employed by Arne Selberg (*Design of Suspension Bridges,* Trondheim, 1946), including the lateral effect of the center cable tie and of lateral tower deflection, although the latter proved to be negligible.

Erection of suspended spans

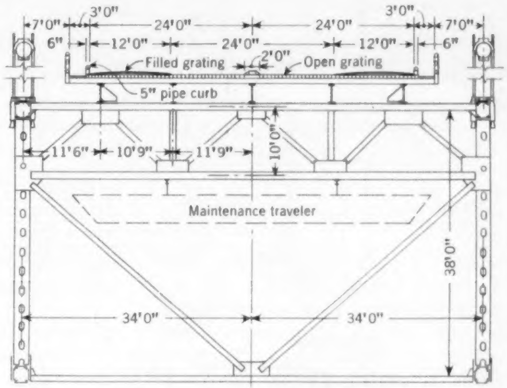
The schedule had provided for completion of the foundations during the 1954 and 1955 seasons, of the main towers and backstay spans during the 1955 season, and of the cables and truss spans during the 1956 season. In order to open the bridge to traffic on November 1, 1957, it was necessary to erect the entire suspension structure containing 16,500 tons of structural steel and 3,500 tons of steel grid by early September, so as to leave time for placing the concrete fill and asphalt surfacing on the filled steel grid. Erection began in the spring of 1957 with the placing of suspenders, followed by erection on the towers of certain roadway steel, the stiffening-truss supporting hangers, and the wind shoes. This



North truss spans



overburden. Elevation is reprinted from "Civil Engineering" for May 1956, pp. 46-47.



CROSS SECTION, SUSPENDED SPAN

erection was done with the use of the derrick boat.

Shop assembly of the stiffening trusses was specified for the purpose of reaming the splices and truss connections so that all chords would be pulled up for tight milled bearing. Assembly was specified in minimum lengths of 300 ft and actually reached a maximum of 650 ft. At the loading dock in St. Ignace the stiffening-truss sections were assembled in pairs in two panels, 80 ft in length overall, with the two floor trusses and bracing. The bridge sections were then set on tracks at the trestle on the dock for loading on barges in pairs to be towed to the point of erection.

Approval was given for the use of high-strength bolts for all field connections in the suspended spans. All high-strength bolts in truss connections were tested by a standard torque wrench, with both an upper and a lower limit set for allowable torque. More than one million high-strength bolts were used in the bridge.

Bridge sections were erected with the use of lifting struts which were run out on the cables to the pick-up points. Hoists were set at the tower, and hoisting ropes were run from that point to the lifting struts to pick up the 100- to 150-ton bridge sections at four points. Erection progressed from main towers in both directions to keep loading and tower deflections balanced. Closure was made at the center of the main span and at the cable bents late in July 1957.

Erection of floor steel and grid followed immediately, again starting from the towers. Steel was raised from the water and run out by straddle buggies, progressing towards the center of the main span and the cable bents to completion Sept. 10, 1957. Placing of the lightweight concrete in the filled steel floor grid started at the towers and progressed in both directions. Concreting was finished Oct. 13, and asphalting was completed Oct. 27, to permit opening of the bridge Nov. 1, 1957.

The lightweight concrete mix contained the following per cubic yard: 450 lb of lightweight expanded-shale coarse aggregate from 3/8 to 3/4-in. size; 1,570 lb of lightweight fine aggregate passing a screen of 3/8-in. mesh; 6 1/2 bags of cement; 1.6 lb of admixture for workability; and 29 gal of water. Slump for the lightweight concrete was 2 to 3 in.; air entrainment was about 6 percent; and strengths exceeded 3,000 psi at 28 days.

On completion of the bridge the cables were 0.85 ft high at the center of the main span, equal to the deflection produced by a load of 100 lb per ft of cable, the allowance for future utilities.

Truss-span approaches

Both approaches over water are continuous steel trusses in four-span units. At each shore the first unit has spans of 160, 200, 200, and 160 ft for each approach. Next come units having spans of 327.5, 393, 393, and 327.5 ft. A secondary rock gorge is located roughly in the middle of the south approach. Although at one time a suspension span was also considered for this part of the bridge, truss spans were found to be more economical. Where the depths to rock are greatest in this secondary gorge, a continuous truss unit is used with spans of 480, 560, 560 and 480 ft for a continuous length of steel of 2,080 ft, believed to be the longest total length of continuous spans. The continuous-truss units are fixed at the center pier and expand from that point in both directions. The roadway expansion joint between the 2,080-ft unit and the adjacent 1,441-ft unit is designed to accommodate a total motion of 2 ft.

The truss spans are of deck construction with the trusses placed below the roadway 34 ft on centers. The 36-in. wide-flange floor beams are framed to the truss verticals below the top chords.

The roadway stringers are continuous and are placed to bear at the top of the floor beams. Bridge members generally are of carbon steel designed for a working stress of 18,000 psi in tension for floor members and 20,000 psi for truss members, except for the more highly stressed truss members, which are of silicon steel designed for a working stress of 27,000 psi in tension.

Truss erection

Truss spans were erected by cantilevering between the bridge piers and temporary steel falsework bents supported on steel piles driven to rock. In general one falsework bent was used for each span, but the last span of the four-span continuous unit was can-

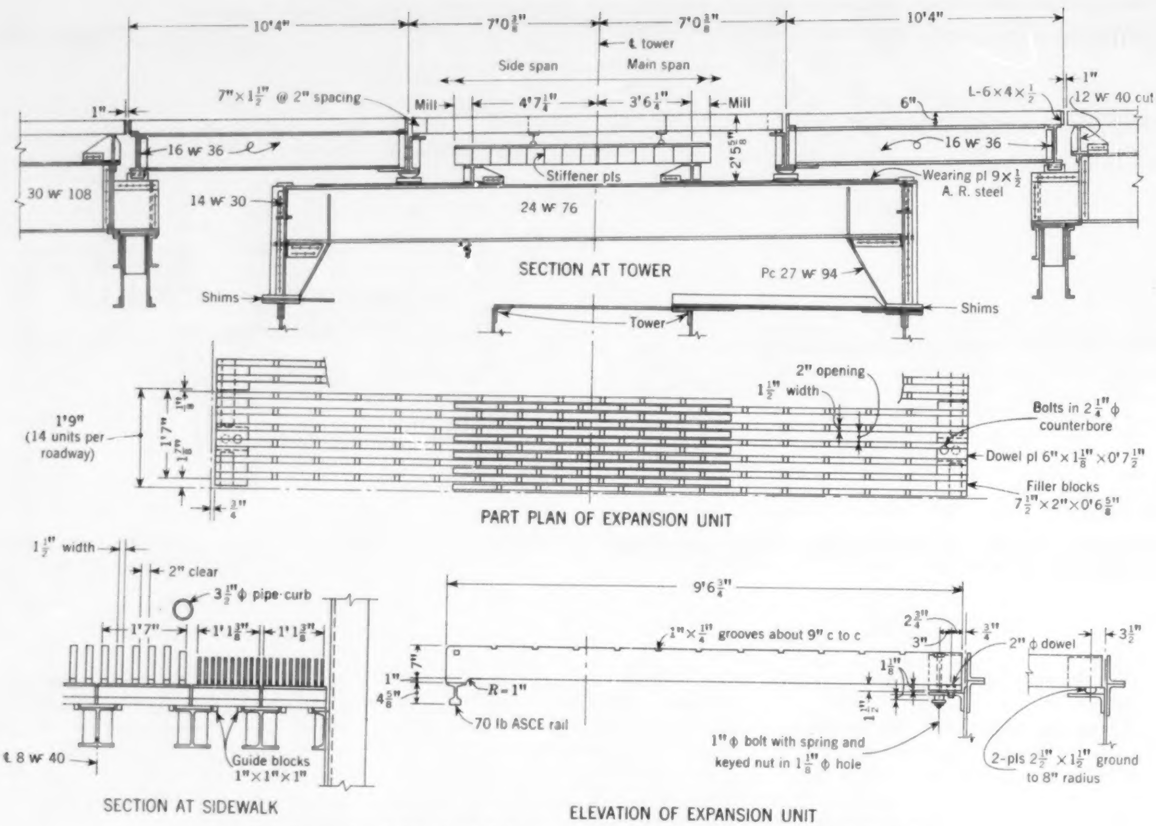


FIG. 2. Expansion joint at each tower accommodates all possible movement including 3 ft of endwise motion in either direction on each side of the tower.

tilevered without the use of a temporary bent. The main-truss steel and bracing were erected with the use of a derrick boat, thus eliminating the heavy load of a large traveler on the erected steel. Second-pass floor steel, however, was erected by the use of a comparatively light traveler.

Of unusual interest is the 468-ft backstay span. It varies in depth from 40 ft at the cable bent pier to 65 ft at the anchorage, and is fixed to the anchorage for economy and greater stiffness. Its depth at the cable bent is such as to align the bottom chord in elevation with that of the adjacent suspended span to maintain continuity of the bottom chord line for best appearance and good architectural design.

According to the original erection scheme, the backstay spans were to be cantilevered a length of four panels or 160 ft from the anchorage, and the remaining 308 ft of truss was to be floated into place on the end of the cantilever and the cable bent pier. Because of delay in completion of the center walls of the anchorage piers, this method was changed. At the suggestion of Dr. Steinman, the entire 468-ft span was floated in, supported on three steel bents set on two steel barges, which were lashed together parallel with the span. The steel that was floated in weighed 700 tons; the roadway stringers were brought in and placed in a separate operation.

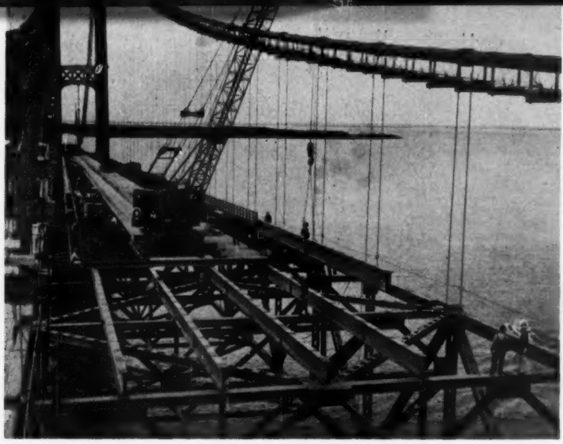
The two spans were floated into position in November and December 1955, just before the close of the construction season. The barges were positioned by anchor lines and water ballast was pumped in to bring the span to exact position. The pins were driven at the anchorage bearings as the other end settled on rockers. This operation required a day for the floating in of each span, which had to be done when there was little wind.

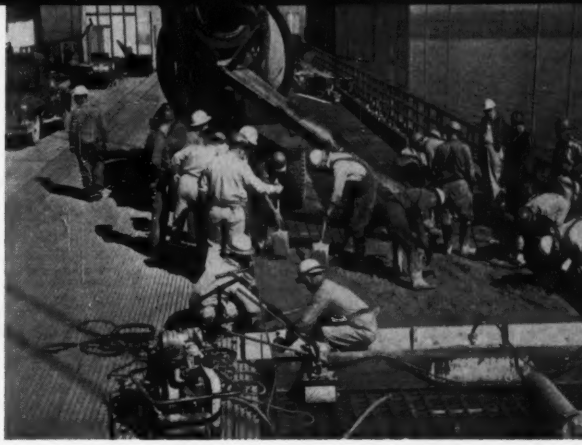
The backstay span remained in the simple-span condition during the winter, until connection to the anchorage tie bars at the top of the anchorage was made in the spring. This was done by jacking up the outer end of the span at the cable bent pier a precalculated amount, sufficient to permit placing of the pin at proper shimmed position in the tie-bar connection. The outer end of the span was then lowered onto that bearing to induce stress in the top-chord anchorage to make it a fixed-end span.

All structural steel in general was given three coats of paint as follows: (1) The shop coat consisted of 75 percent red lead and 25 percent iron oxide in a fractionated linseed oil vehicle; (2) the first field coat consisted of 30 percent red lead and 60 percent iron oxide in a fractionated linseed oil vehicle; and (3) the final field coat was made up of 75 percent C. P. chrome green and 25 percent magnesium silicate in a synthetic-resin vehicle.

The final coat of paint for the bridge is foliage green with the exception of the main towers, which are ivory. The ivory coat is 96 percent titanium bioxide and 4 percent zinc oxide in a synthetic resin vehicle. The final coat on the inside of the towers is aluminum in a glycerol-phthalate resin-varnish vehicle.

The contract for the placing of the 11,000 cu yd of concrete deck over a length of 10,243 ft was a joint venture, one contractor being responsible for the north approach and suspended spans, and the other for the south approach





"Second pass" of erection includes placing of deck stringers and preassembled steel deck units. Center section is a permanent open grid. Outside roadways are concrete-filled steel grid. Lightweight concrete was delivered by transit-mix truck.

spans. With essentially the same job to perform, the two joint venturers employed quite different methods.

During the first (1956) construction season, before completion of the approach viaducts, concrete for the north end of the bridge was delivered by transit-mix trucks and raised to a hopper on the deck by a crawler crane. Scoot-crete power buggies distributed the concrete. Screeding was done in a transverse direction with a 12-ft vibratory unit which ran on pipe screed rails laid transverse to the bridge from the mall to each sidewalk.

For the south end, it was necessary to construct a temporary timber-and-steel stringer trestle to give access to the deck at Pier 1. Transit-mix concrete was then delivered via this trestle and the deck, as it was completed, to a Pump-crete station from which the concrete was pumped a maximum of 1,000 ft to the point of deposit. As the work progressed, the Pump-crete station was advanced along with the deck. A longitudinal construction joint was provided along the center line of the mall on both approaches. On the south side, screeding was done in a longitudinal direction with a vibratory screed which spanned from a screed rail over the center stringer to a similar screed rail at the curb.

Because of the continuity of steel construction, it was necessary to place the concrete in a staggered sequence to minimize differential deflections between the several spans and the two trusses. Thus the contractor could not complete the spans in succession. The sequence was arranged, however, to permit placing of the greater part of the concrete for one roadway in each four-span unit before the second roadway was commenced, thus providing working space and room for concrete trucks without running on new concrete until it had attained adequate strength. The maximum length of pour between steel sliding joints on the truss spans was 160 ft.

Concrete on the suspended spans was placed in a balanced staggered pattern by transit-mix trucks traveling mostly on the open-grid center sections. Plywood laid on the grid to be filled with concrete permitted trucking over it.

Inspection and maintenance travelers of steel are provided for each suspension span and for the truss spans. Two travelers are used for the south truss spans and a single traveler for the north truss spans. Inspection walks are used in the backstay truss spans and in the first truss span at the shore end of each approach.

The traveler for the suspension spans has an open grid platform 6 ft wide and 53 ft long transverse of the bridge. This traveler is designed for a live load of 40 psf and for a total dead load and live load of 33,000 lb including impact. It is placed immediately below the floor truss and is hung from rails attached to the bottom chord of the floor truss. The traveler is driven by a 10-hp motor with power supplied by a gasoline electric generator of 10-kw capacity.

The 6-ft by 20-ft 8-in. platform of the truss-span traveler is suspended from the 26-ft-long main frame on trolleys to permit lateral movement. The main trolley for longitudinal movement runs on rails set 20 ft 6 in. apart and fixed to the bottom flange of the bridge floorbeams and to intermediate braced hangers. The total dead and live load for this traveler is 21,000 lb, including impact.

Personnel

Members of the Mackinac Bridge Authority are: Prentiss M. Brown, Chairman; the late Charles T. Fisher, Jr., Vice Chairman; Mead L. Bricker, William J. Cochran, Murray D. Van Wagoner, M. ASCE, George A. Osborn, the late Fred M. Zeder, Charles M. Ziegler, and John C. Mackie, Members; with Lawrence A. Rubin, Executive Secretary, and Sanford A. Brown, Treasurer. D. B. Steinman, M. ASCE, Consulting Engineer, was retained by the Authority for design and supervision of construction. Glenn B. Woodruff, M. ASCE, Consulting Engineer, was retained by Dr. Steinman as consultant.

Design and office supervision of construction was divided among Dr. Steinman's associate engineers as follows: Substructure and Main Towers, R. M. Boynton; Cable Work, W. E. Joyce, M. ASCE; Superstructure, C. H. Gronquist, M. ASCE; and Approach Viaducts and Roads, Toll Collection Facilities, and Administration and Maintenance Buildings, J. London. J. W. Kinney was Resident Engineer in charge of Supervision of Construction.

Assistants to the Associate Engineers were as follows: Substructure and Main Towers, A. Werth; Cable Work, A. Ostrank; Suspension Superstructure, I. S. Hansen; Truss Spans Superstructure, A. I. Zuckerman; Approach Viaducts and Roads and Toll Collection Facilities, B. Garfinkel; Administration and Maintenance Buildings, A. Slavin, M. ASCE; Supervision of Construction, W. P. Frye, W. G. Dallas, R. M. Garrard, J. M. ASCE.

Triangulation and loctation of piers were performed by the G. Edwin Pidcock Company, Allentown, Pa.

The superstructure and deck contractors and the amounts of their contracts were: superstructure, American Bridge Division of U. S. Steel Corp., \$43,735,000; deck concrete and St. Ignace approach viaduct substructure, Louis Garavaglia and Johnson-Greene Co., \$2,250,000. The Merritt-Chapman Scott Corp. constructed the substructure under a \$25,735,000 contract.

Longest bridge cables ever constructed

W. E. JOYCE, M. ASCE, Associate Engineer with D. B. Steinman, Consulting Engineer, New York, N. Y.

The two main cables of the Mackinac Bridge are the longest bridge cables ever constructed, being 8,684 ft from strand shoes to strand shoes at each anchorage. Each cable consists of parallel wires laid up in 37 strands of 340 wires each, giving a total of 12,580 wires per cable. An extra strand of 240 wires is strung from each cable bent saddle to the adjacent anchorage.

Cable wire is cold-drawn basic steel, galvanized, having a specified average minimum ultimate strength of 225,000 psi and an average yield point of 158,300 psi. Actual tests of the wire used showed ultimate strengths varying between 228,000 and 246,000 psi. The average diameter of the wire is 0.196 in., including galvanizing. The modulus of elasticity is 28,000,000 psi. Each cable has a cross-sectional area of 379.5 sq in. of metal. The maximum tension for dead load plus live load plus temperature is 31,817,000 lb per cable.

Rods for the cable wire were rolled at the Donora, Pa., plant of the American Steel and Wire Division of the U.S. Steel Corporation, and the wire drawing and galvanizing were done at their Trenton Plant. After galvanizing, the wire was wound into coils of 5-ft diameter weighing 350 to 500 lb each and shipped to Sault Ste. Marie, Mich., where it was stored until the reeling operation was commenced by the contractor, the American Bridge Division, U.S. Steel Corporation. The cost of the cable items in the general superstructure contract was $14,118,866.

Early in the spring of 1956, the reeling of the cable wire was started. Coils were spliced together with left-hand and right-hand threaded nipples and wound onto steel reels, which held 16 tons of wire. About 700 reels of wire were used in the cables. The 37 strands of each cable were laid up in circular bored saddle castings at the tower tops, cable bents and splay points. At mid spans during construction, the strands were in the form of a hexagon (Fig. 1).

As the cable bents are vertical under the full dead and live load of the suspended structure, special care was taken to prevent the cable bent from slipping on the cable due to the thrust of the cable reaction. The saddle cover casting resting on the cable on the sidespan half of the saddle was clamped to the base casting with fourteen 2¼-in. high-tensile-strength bolts, tightened to a tension of 40,000 psi. In addition, a special strand shoe was fastened to the backstay half of the saddle. A special loop strand, previously mentioned, called Strand 38, of 120 wires, was strung from this strand shoe to strand shoes on a separate anchor chain in the anchorage. See Fig. 2. This loop or double strand was adjusted to the completed hexagonal 37-strand cable and then compacted into the finished cable from the cable bents to the splay saddles.

At the splay points inside the anchorages, where the cable strands flare out vertically and horizontally for attachment to the anchorage steel, there is a downward break in the vertical alignment of the cable of about 5 deg. Thus all strands rest on the splay casting and there was no uplift, even during the stringing of the cable. The splay casting rests on four segmental rollers of 21-in. diameter, 8 in. thick and 5 ft long, to permit movement of the splay casting under varying stress of the cable under dead and live load. The rollers rest on a steel base plate 5 ft 6 in. × 5 in. × 5 ft 6 in., bolted to the concrete of the anchorage.

The anchorage steel for the ends of each cable consists of seven girders set normal to the center line of the cable in the vertical plane and spaced 4 ft 9⅝ in. center to center in the horizontal plane. Anchor bars consisting of two plates 26 in. × 1 in. × 44 ft long, riveted to the anchor girders at one end and pinned to the 12-in. × 3¾-in. × 18-ft eyebar adjusting link at the other end, transmit the pull of each cable strand to the girders. Girders and anchor bars are structural carbon steel, and the adjusting links are special eyebar steel. The adjusting eyebar links were flame cut from full sized plates and then annealed.

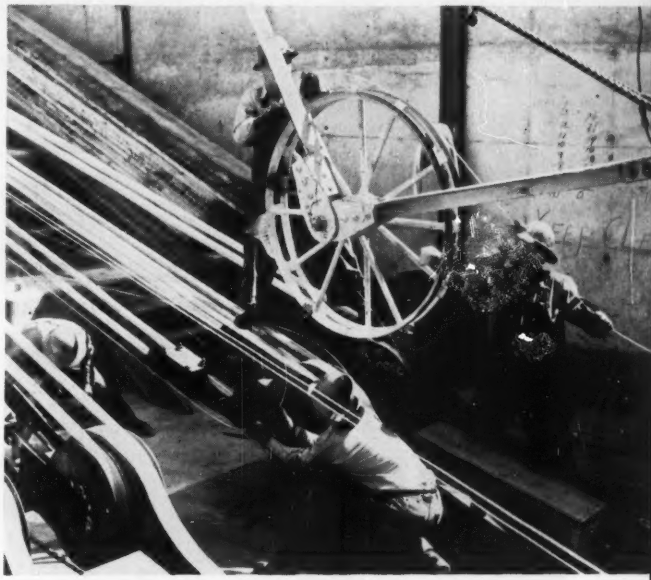
The outer girders are connected to three cable strands, the center girder to four strands, and the remaining four girders to seven strands each. The entire assembly of girders, anchor bars, and adjusting links is encased in the concrete of the anchorage except for about 3 ft of the adjusting links, which protrude from the concrete with the cable-wire strand-shoe connection.

Below the splay saddles, each strand separates into two halves and each half passes around a strand shoe on each side of the adjusting link. Therefore 85 wires pass around each strand shoe, which is a grooved circular plate 3½ in. thick and 1 ft 11½ in. in diameter, with a groove 1⅝ in. deep connected to the adjusting link by a pin of 9-in. diameter.

Cable bands

All cable bands, except the heavy band at the mid point of the main span, are semicircular steel castings bored to a diameter of 24½ in., with the halves held 1 in. apart. At suspender locations each band has a groove for one suspender-rope loop cast on the outside surface at an angle varying with the longitudinal axis of the band so that all suspender loops are vertical. High-tensile-strength bolts of 1¾-in. diameter are used to clamp the two halves of the band to the cable.

Sixteen cable wires were laid in each round trip of the two double spinning wheels, shown meeting at center of span. Nine-foot lengths of 8-in. pipe, supported at the top by two 1-in.-dia strands, carried two structural frames, with three sheaves to guide the 1-in. hauling rope. There were 17 pipe supports for the hauling rope in the main span, 8 in each side span, and 2 in each backstay span. These frames also carried two 200-watt lights for two-shift operation.



Workman in foreground has taken wire from incoming wheel and is looping it over strand shoe at anchorage. Other workmen put new strand on wheel for return trip.

FIG. 1. Strands in uncompacted cable (immediately below) and strand shoes in anchorage (bottom) are arranged as shown.

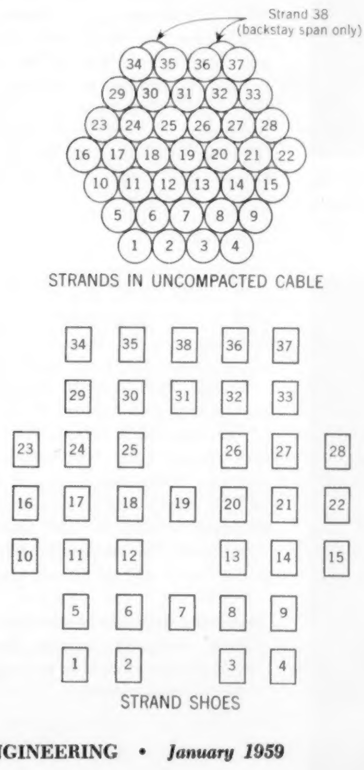
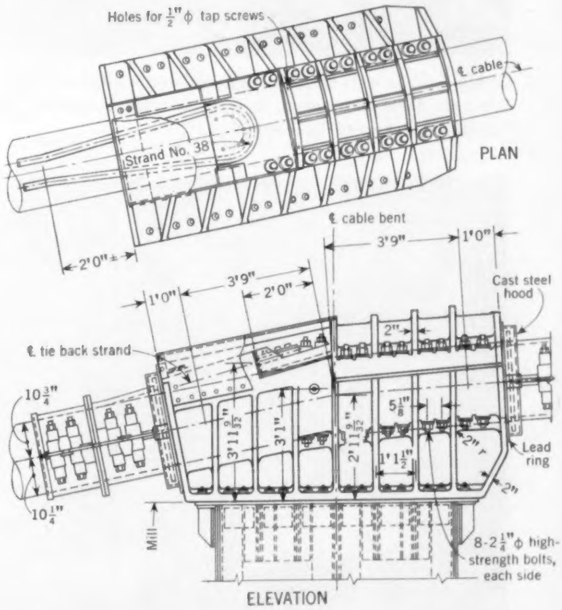
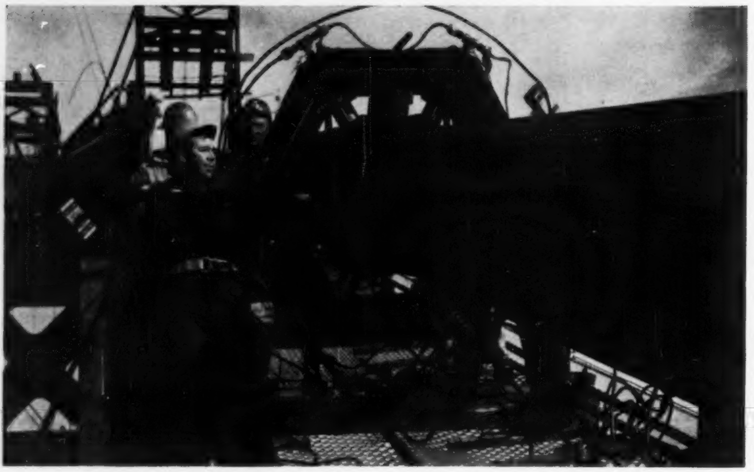


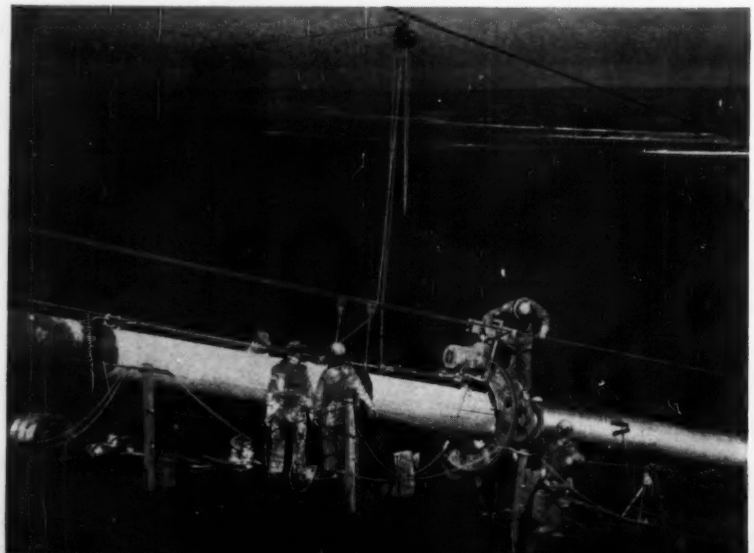
FIG. 2. Special saddle was required at the cable bent to prevent slippage of the cable. Note looping of 120 strands at top of casting to form a special tieback for the saddle.



Partly completed cables frame U. S. Steel Corporation ore freighter.



Cable, laid in a hexagonal pattern, was squeezed into a circular cross section by this unit. Five wire ropes, later to become suspender ropes, carried the chainlink fencing that served as catwalk.



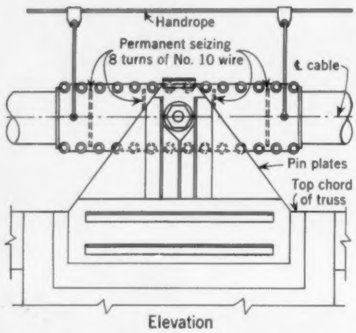


FIG. 3. Cable band was used at mid-span to transfer 1,290 kips of longitudinal wind load from the truss to the cable.

Five types of bands were used having 4, 6, 8, and 10 bolts. The shortest band is 1 ft $6\frac{1}{2}$ in. long and the longest bands, near the towers, are 3 ft $1\frac{1}{2}$ in. long. Short four-bolt bands 12 in. long, without suspender grooves, are used in the backstay spans, spaced at 52 ft to hold the hand-rope standards. The minimum thickness of regular cable bands is $1\frac{1}{8}$ in. At the mid point of the main span a special band was used to transfer the longitudinal wind load of 1,290 kips from the truss to the cable. This band is 9 ft 4 in. long, with 28 high-strength bolts of $2\frac{3}{4}$-in. diameter. See **Fig. 3.**

A heavy coat of red-lead paint was applied to the cable before the cable bands were placed. The high-strength bolts were tightened to 40,000 psi when the bands were placed, retightened when the dead load of the truss and floor system was added, and given a final tightening to 40,000 psi after the cables were wrapped. After final tightening of the bolts, the openings between the halves of the bands were calked with lead wool to make the joint waterproof.

Suspenders

The suspenders are galvanized steel-wire ropes about $2\frac{1}{4}$ in. in diameter, with a wire-rope center. Specifications for the wire for suspenders were the same as for the main cable wire.

Simple button-type forged sockets on the ropes fit into boots on each side of the top-chord trusses. At the top of the chord there are special clamp castings with zinc liners to take care of the slight change in angle of the suspenders due to the difference of spacing of the suspender parts at the cable band and at the top chord.

Annealed galvanized wire was tightly wrapped around the red-lead-coated cables to form a weathertight jacket.

Tests were made on straight lengths of suspender rope and also on two parts of suspender rope looped over a sheave having a diameter approximately equal to that of the cable-band suspender groove. Tests of the straight ropes gave an average ultimate strength of approximately 572,000 lb, and tests of two parts over a sheave gave an ultimate strength of 1,047,000 lb for an efficiency of 91.5 percent.

Suspender lengths were measured while the rope was held under a tension of 58,000 lb at 68 deg F. All measuring of suspender lengths, cutting and socketing, was done at the Trenton Plant of the American Steel and Wire Division. After socketing, the longer suspenders were placed on reels and the short suspenders were coiled for shipping to the bridge site.

Two galvanized steel bridge strands of 1-in. diameter are set about 4 ft above the center of each main cable and held down at each cable band by verticals of 7/8-in. diameter. The hand ropes, or more correctly, hand strands, in the main span extend from tower to tower, with turnbuckles at each tower for adjustment. In the side spans and backstay spans, the hand ropes extend from an eyebolt in the face of each anchorage to the main tower, passing over a support at the cable-bent saddles. There are turnbuckles at the main tower ends for hand-rope adjustment. High-strength bridge strands were used at the request of the contractor, who made use of these strands as hauling-rope supports during cable construction.

Construction of the cables

Erection of the catwalks and cable spinning equipment was started in the early spring of 1956. Separate catwalk ropes were used in each span, five ropes to each catwalk. The two catwalks for main-cable erection were each 9 ft wide with a 2-in. cyclone-fencing wire-mesh floor supported by 6 x 8-in. cross timbers spaced 10 ft on centers.

Sections of the catwalk 100 ft long, folded accordion-wise, were hoisted to the tops of the towers and slid into place along the catwalk ropes. The two catwalks were then braced with six cross bridges between walks in the main span and two in each side span and by two inverted parabolic storm cables per walk. The storm cables were 1½-in. standard hoisting ropes in the main span, 1-in. ropes in side spans, and ¾-in. ropes in backstay spans. The storm ropes were connected to the catwalks with ½-in. wire rope placed vertically at 100-ft centers.

The wire hauling sheaves were of 4-ft diameter with double grooves for carrying two bights of cable wire. Two of these hauling sheaves or spinning wheels, attached to a loop of 7/8-in. hauling rope per walk, shuttled from anchorage to anchorage spinning 8 wires for each trip, or 16 wires per round trip. Cable wires, pulled by the hauling sheaves, passed from the reels on the anchorages to floating sheave towers. An arrangement of counterweights together with brakes on the wire reels regulated the tension in the wire being drawn from the reels so that there was no slack wire even though the speed of the hauling sheave was variable. Assuming the bridge wire to weigh 0.1025 lb per lin ft, one round trip of the two spinning wheels laid 14,250 lb of wire for one cable.

For the first four strands in each cable, the wires were laid in the saddles at the splay points, cable bents and main towers and then were adjusted to guide wires set previously to correct elevation or sag. After the stringing of these strands was completed, they were set by instrument to correct sag positions for the unloaded cables.

All subsequent strands were strung in the saddles on top of existing strands and about one foot higher at the middle of the spans so that the strands hung freely during the adjustment of wires during stringing. When the stringing of these strands was completed, the strands were adjusted to final position relative to the strands already adjusted finally in the cables. This was done by sliding the strands through the tower saddles into the main span and then making final adjustment, for the side span and backstay, at the adjusting links in the anchorages.

Stringing of strands proceeded on one catwalk while final adjustment of strands in the main cable was being done on the other walk. Spinning of the cables started July 18, 1956, and both cables were completed October 19, 1956. Total weight of wire in the two cables is 11,089.5 tons.

After all the strands were adjusted in final position in the cable, the hexagonal cable was squeezed into a circular cross section about 24½ in. in diameter. Eight squeezers, each having six hydraulic jacks with rams of 4½-in. diameter and shoes to fit the final curvature of the finished cable, were used for this operation.

When the cable bands were in place, the catwalks were lashed to the main cables and the catwalk ropes removed and shipped back to Trenton, N. J. Here they were measured, under suspender dead-load stress, and cut up into suspender lengths. The suspender ropes were socketed and shipped back to the bridge site for erection in the spring of 1957. Suspenders were erected from barges in the Straits and looped directly over the cable bands.

On this bridge, concrete fill in the steel grid deck is a small proportion of the total dead load of the suspended structure. Therefore wrapping of the main cables was permitted to start at the completion of the second pass of the suspended-span steelwork erection and to proceed as the concrete and asphalt in the deck were placed.

Wrapping wire is soft, annealed, galvanized steel wire, of 0.150-in. diameter over galvanizing. Four Robinson-type wrapping machines, each carrying three bobbins of wrapping wire, about 7,670 ft of wire, completed the wrapping of the two main cables in 29 two-shift working days, Sept. 16 to Oct. 24, 1957. Total length of cables wrapped is 16,136 lin ft.

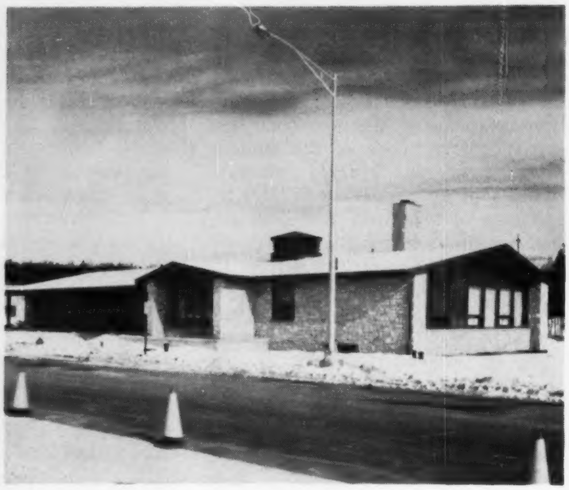
A heavy coating of lead paint, sometimes referred to as red-lead paste, was placed on the cables just ahead of the wrapping machines. The wrapping wires, wound into this red-lead coating, formed a tight waterproof seal for the protection of the cable wire. At both ends of each panel, the ends of the wrapping wires were calked into the grooves at the ends of the cable bands with lead wool.

After erection the cable wrapping, suspenders, hand ropes, and all other galvanized surfaces were given a priming coat of galvanized metal primer of zinc dust-zinc oxide glycerol pthalate vehicle type. This was followed by one coat of medium gray and a final coat of foilage green synthetic-vehicle paints. Cable bands and bolts, saddles, adjusting links, and strand shoes were given a shop coat of red-lead and iron-oxide paint and the two field coats used for the trusses. In the anchorage chambers, the final coat on the cables, adjusting links, and strand shoes was aluminum.

TABLE I. Cable data

Length, strand shoe to strand shoe at anchorages	8,683.7 lin ft
Area of each cable	379.5 sq in.
Number of wires in each cable	12,580
Number of strands in each cable	37
Diameter of each cable, average	24.5 in.
Diameter of each cable wire, average	0.196 in.
Total length of wire in two cables	41,000 miles
Total weight of two cables	11,089.5 tons
Anchor bars, adjusting links and girders for both anchorages	1,222.1 tons
Suspenders, 2½-in.-dia wire ropes	456.8 tons
Cable saddles and cable bands, cast steel	471.6 tons
Suspender sockets and fittings	139.0 tons
Wrapping wire	249.8 tons

MACKINAC BRIDGE



Approaches,

J. LONDON, Associate Engineer,

Access and toll collection facilities as well as the complete lighting system for the Mackinac Bridge are of special interest. The approaches and toll plaza were designed to utilize existing topographical features to the best advantage. There was considerable freedom in planning since few roads and no railways traverse the area.

The north end of the Mackinac Bridge structure terminates at the end of a 3,600-ft mole, which was constructed by the Michigan State Highway Department in 1941-1943 to shorten the ferry route. Route U.S. 2 runs at a right angle to the bridge, and 4,200 ft inland from the shore. The ground on the north shore rises sharply and is about 120 ft higher than the mole at the intersection of Route U.S. 2 with the bridge approach.

Cuts as deep as 60 ft were required to limit the upgrade of the roadway to 3 percent. The maximum downgrade is 3.1 percent. A strip of property 2,500 ft wide, extending 600 ft beyond Route U.S. 2, had been acquired in connection with the construction of the mole. The State Highway Department turned the mole and the strip of property over to the Mackinac Bridge Authority for the north approach to the bridge. No additional property was acquired by the Authority.

The Highway Department obtained fill for the mole by starting a cut in the hillside for the roadway towards Route U.S. 2. The bridge approach roadway was aligned to take advantage of this cut. Additional excavation for the bridge project, amounting to about 500,000 cu yd, was disposed of locally by building up the mole by several feet, by raising the low area for a toll plaza, and by extending the shore line.

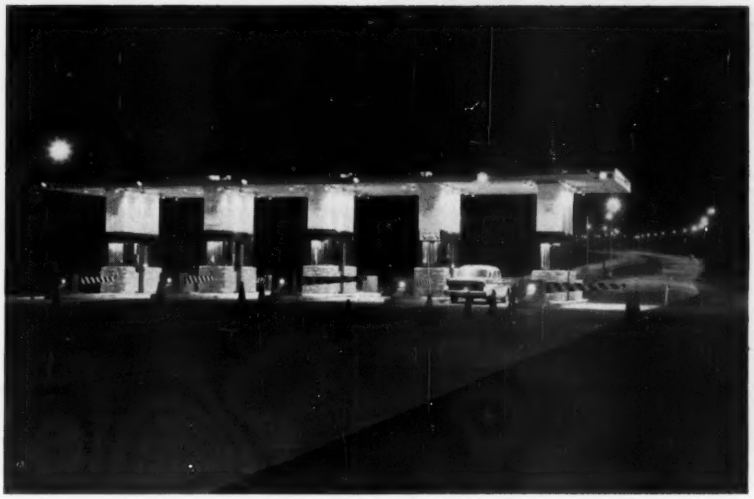
The Mackinac Bridge proper was located in line with the mole to reduce the length of the structure. The north approach roadway swings west of this line to continue north in the future as a new highway to Sault Sainte Marie. At present the bridge approach roadway forms a T-intersection at Route U.S. 2 with full traffic interchange access. Additional access ramps, required when the roadway will be extended northward, are provided for.

The south end of the Mackinac Bridge terminates at a pier near the shore line of Michilimackinac Park in Mackinaw City. A beam viaduct carries the bridge roadway across the park. Continuing southward, a limited-access highway, built by the State Highway Department, connects with principal routes leading west, south and east. Parts of the approaches were built with 50-percent federal aid as part of the Interstate Highway System.

The mole, when turned over to the Mackinac Bridge Authority, was trapezoidal in section. Its top was about 5.5 ft above high water and 10 ft above low water with an average height of fill of 20 ft. It was founded on a layer of hard red clay from 7 to 12 ft thick. Below the hard red clay there is a layer of soft red clay from 14 to 32 ft thick over firm bottom. The presence of this soft layer made it inadvisable to build up the mole to any great extent. The final roadway crown is not generally higher than 3.25 ft above the original mole surface.

The mole has a nominal width of 80 ft at the top and a side slope of $1\frac{1}{2}$:1. The sides are protected by a 6-ft-thick layer of stones of 10-ton minimum weight over a 4-ft-thick layer of 1- to 5-ton stones. The main fill is rock, topped by 18 in. of earth. The two 23-ft roadways, a 2-ft center mall, and two 7-ft shoulders require a total width of 62 ft. The remaining available width is used for railings, lampposts, junction boxes and conduits.

The roadway at the north end of the approach trusses, at Pier No. 34 at the south end of the mole, is about 30 ft above the mole. The roadway is brought down to the level of the mole by a beam viaduct consisting of fourteen 50-ft beam spans, divided into three units of four continuous spans and one unit of two continuous spans.



An existing 3,600-ft mole was utilized for north approach to Mackinac Bridge, as seen in view at far left. Note toll plaza and Administration Building at water's edge. Administration Building, seen in middle view, has attractive exterior of stone and glass. Initial installation provides five toll booths, shown in view immediately at left. Provision has been made for adding five more booths. Roadway lighting is provided by G. E. H 400 EW 1, 23,000-lumen lamps for good transverse light distribution.

toll plaza and electrical system

with D. B. Steinman, Consulting Engineer, New York, N. Y.

The cross-section has five 33-in. interior beams and two 30-in. exterior beams. A $7\frac{1}{2}$-in. reinforced concrete slab carries two 23-ft roadways with a $1\frac{1}{2}$-in. bituminous concrete wearing surface, a 2-ft mall, two 8-in.-wide curbs and two emergency sidewalks, each 2 ft 4 in. wide.

Piers for the viaduct are two-column reinforced concrete bents. Columns are 32 ft apart center to center; top struts cantilever 11 ft 7 in. past the columns. Footings are on 14-in. 117-lb H-piles driven through the mole to rock. Corner piles are battered in both directions to provide stability against possible movement of the mole. The piles are oversize for many of the footings, but it was expeditious to use them as they had been left over from the piers of the main structure.

The mall is surfaced with 9 in. of reinforced concrete on the two lanes of each roadway. The outside lanes are 12 ft and the inside lanes 11 ft wide. A subbase 1 ft thick was placed across the full width of the mole. About 1.5 ft of earth fill was required on the original mole surface to bring the roadway to grade. The shoulders were paved with bituminous aggregate surfacing weighing 150 lb per sq yd.

The toll plaza is about 12 ft above the original ground level. This elevation of the toll plaza provided a number of benefits. It absorbed a considerable amount of material from the roadway cut, and it reduced the amount of excavation required for the tunnel under the toll booths, for the administration building, for the garage and maintenance building, and for the storm-water drains. The fill also permitted placing the toll booths at a high point to minimize the water and ice that may accumulate on the pavement at the toll booths.

Toll plaza

At present there are five toll booths in a 92-ft width of concrete pavement, to collect tolls from six lanes. The toll islands are 6 ft 5 in. wide and the lanes between them are 10 ft 1 in. wide. Provision is made to add two booths and a 35-ft roadway at each side of the present group for a total of ten lanes and a pavement width of 162 ft. All utilities, such as lighting, conduits and sewers, are located outside the future width of the plaza.

The toll plaza is about 700 ft in length, with the toll booths placed about 50 ft north of the center. This arrangement was planned to provide more storage space for northbound traffic as experience has shown that northbound traffic is more concentrated than southbound traffic.

The toll collection system is of the barrier type and was installed, together with the toll booths and canopy, by Taller & Cooper. There are twelve traffic classifications, which correspond as far as possible to vehicle axle counts. The classifications punched by the collectors on the button boxes in the toll booths are recorded on registers in the Administration Building. To check the collectors, axles are counted by means of treadles in the traffic lanes, and overhead indicators on the canopy show the classifications punched by the collectors. The amount of the contract for the toll collection system, booths and canopy, was $150,000.

The south end of the trusses of the Mackinac Bridge is at Pier No. 1, which is near the shore line of Michilimackinac Park in Mackinaw City. The bridge roadway is carried across the park on a beam viaduct of fourteen 42-ft simple-beam spans with a $7\frac{1}{2}$-in. reinforced concrete roadway slab and a $1\frac{1}{2}$-in. bituminous concrete wearing surface. The beams are carried by two-legged reinforced-concrete frame piers, similar to those in the north approach viaduct, founded on gravel or rock. The viaduct has two 23-ft roadways, separated by a 2-ft mall, and two 2-ft 4-in. sidewalks. The deck is drained by scuppers about 160 ft apart, connected by leaders to an 18-in. storm-water sewer, which empties into the lake.

The total length of the Mackinac Bridge, from Route U.S. 2 on the north to Straits Avenue in Mackinaw City on the south, is about 5.4 miles. To illuminate this length of roadway and structure, six substations were built, No. 1 near the Administration Building, No. 2 at the north anchorage, No. 3 at the north main tower, No. 4 at the south main tower, No. 5 at the south anchorage, and No. 6 under the south approach viaduct. Power for Substations 1, 2 and 3 is furnished by Edison Sault Electric Company of St. Ignace, Mich., from the north, and for Substations 4, 5 and 6 by Consumers Power Company of Jackson, Mich., from the south. The bridge electrical system is thus divided into two parts at the center of the main suspension span so as to provide light and power from two independent sources. An emergency cross connection between the two systems was not considered warranted; half the bridge will be without illumination in the case of failure of one power supply. When power fails, automatically controlled, gasoline-driven generators, located at five substations, will provide emergency energy for indispensable services, such as toll facilities, the heating plant in the Administration Building, navigation lights, and aerial beacons on the tower tops.

Power is brought into Substations 1 and 6 by three-phase, four-wire, 60-cycle, 2400/4160-volt services and continues to the other substations on the bridge. At each substation, step-down distribution transformers, through their secondaries, furnish three-phase, four-wire, 120/208-volt 60-cycle current for low-voltage, multiple circuits. Power is also supplied at 2400 volts at each substation to the primary sides of constant-current transformers for providing 6.6-amp series lighting circuits for the mercury-vapor light system.

Substation 1 is a reinforced concrete, stone-faced building about 17 x 46 ft in size. Substation 6 is a reinforced concrete building about 12 x 19 ft. The remaining substations are steel platforms, suspended underneath the bridge structure, enclosed with wire fencing and roofed against weather.

Substation equipment listed

A list of the principal pieces of equipment at each substation and their use is descriptive of the distribution system.

At Substation 1. Three single-phase 100-kva distribution transformers, Y-connected to give a secondary voltage of 120/208. These transformers furnish light and power for the Administration Building and Toll Booths.

Six 25-kw, 2400-volt, constant-current transformers. Four of these furnish current for four 6.6-amp series lighting circuits along the bridge approach roadway. The remaining two transformers furnish current for two circuits that illuminate the toll plaza, the mole, and the north approach viaduct.

One 35-kw. 120/208-volt, 60-cycle, fully automatic gasoline-engine-driven electric generating plant. This unit furnishes emergency current for lighting the toll booths, and for running the toll collection equipment and the heating plant in the Administration Building.

At Substations 2 and 5. Three single-phase 5-kva distribution transformers, Y-connected to give a secondary voltage of 120/208. These transformers furnish current for navigation lights on the anchorages and adjacent piers and lighting of the anchorage chambers and cable bents.

One 25-kw, 2400-volt constant-current transformer to furnish current to the roadway lighting on the approach trusses.

One 5-kw, 120/208-volt, 60-cycle fully automatic gasoline-engine-driven electric generating plant to furnish emergency current for the navigation lights.

At Substations 3 and 4. Three single-phase 25-kva distribution transformers, Y-connected to give a secondary voltage of 120/208. These transformers furnish current for navigation lights on the main piers and along the center suspension span, for lights along the main cables of the bridge, floodlights for the towers, aerial beacons, fog bell, and elevators in the tower legs.

One 25-kw, 2400-volt constant-current transformer to furnish current to the roadway lighting on the suspension spans.

One 10-kw, 120/208-volt, 60-cycle, fully automatic gasoline-driven electric generating plant to furnish emergency current for the navigation lights, aerial beacons, and fog bell.

At Substation 6. One single-phase 15-kva distribution transformer, 2400 volts to 240/120 volts, for a three-wire system to illuminate the parking space under the deck of the approach viaduct.

One 25-kw, 2400-volt, constant-current transformer to furnish current for the roadway lighting on the approach viaduct and on part of the adjacent approach trusses.

The mercury-vapor lights on the roadways are set about 155 ft apart, staggered, on aluminum poles. The lamps are type H400-E1, 400 watt, 20,000 lumen. Each lamp is provided with a transformer ballast, designed for 6.6 amp in the primary, supplied by the constant-current transformers. The luminaires are General Electric Form 400. The assembly is designed to distribute light longitudinally along the roadways. The intensity of illumination at the roadway surface is approximately 1 ft-candle. At the toll plaza, which is laid out for a maximum width of 170 ft, the lights are spaced 90 ft apart along the east and west boundaries. General Electric type H400-EW1, 23,000-lumen lamps are used here as they give a better transverse light distribution than the type H400-E1 lamps used along the roadways. Lighting is turned on and off by photoelectric controls.

All electric cables along the bridge are enclosed in steel conduits, hot-dip galvanized inside and outside. Exceptions are exposed aerial electric cable for lighting the main cables of the suspension spans, and use of Transite, concrete-encased, subsurface conduits along the north approach roadway. Particular attention was paid to drainage of all conduits and service boxes.

The construction costs of the electrical contracts were as follows:

South approach viaduct. . . .	$20,650
North approach roadway . . .	94,234
Suspended spans, approach trusses, north approach viaduct, mole and toll plaza . .	794,894
	$909,778

It is a tribute to the cooperation and industry of the contractors that they worked simultaneously in overlapping areas and completed their contracts in limited periods of time to meet the scheduled date of November 1, 1957, for the opening of the Mackinac Bridge.

General construction was handled by the following: steel for north and south approach viaducts, American Bridge Division of U. S. Steel Corporation; substructure and deck for north and south approach viaducts, Louis Garavaglia and Johnson-Greene Company; toll plaza and roadway on mole, Louis Garavaglia; grading and drainage of north approach roadway, S. J. Groves and Sons Company; paving and lighting of north approach roadway, A. Lindberg and Sons and Bacco Construction Company.

The electrical contractors were: Blumenthal-Kahn Electric Company for the approach trusses, suspension spans, north approach viaduct, mole and toll plaza; Hatzel and Buehler, Inc., for the south approach viaduct; and Cloverland Contracting Company for the north approach roadway. The Administration Building and the Garage and Maintenance Building were designed by Harley, Ellington and Day, Inc. of Detroit.

Except as otherwise noted, all plans and specifications for the approaches, toll plaza and electrical system were prepared in the office of D. B. Steinman, Engineer for the Mackinac Bridge Authority. J. London was in general charge except for the electrical work on the main spans and approach trusses of the bridge, which was under C. H. Gronquist, M. ASCE. J. W. Kinney was Resident Engineer at the bridge site.

Stepped masonry spillway at Croton Dam has been lowered 6 ft to El. 196 except for short section adjacent to the main dam (at left), where flashboards remain to protect the abutment.

F. B. MARSH, M. ASCE,
Former Associate Editor,
Water Works Engineering,
New York, N. Y.

Croton Dam spillway lowered after fifty years of service

When completed in 1906, after a fourteen-year construction period, the "new" Croton Dam on New York City's Westchester watershed was referred to as "the most stupendous structure of its class in the world." The maximum height of the dam is 297 ft, of which only half appears above the fill placed against the downstream face.

The masonry spillway runs along the side of the rock cut above the dam and almost at right angles to it. The spillway varies in height from about 150 ft at its junction with the main dam to 10 ft where is meets the rock bluff. The 1955 record flood caused serios cracks in this spillway and led to the discovery that for fifty years the structure had been potentially unsafe. This condition was caused by changes during construction which left the foundation and lower portions of the structure as originally designed but raised the masonry crest 4 ft for 750 ft of its length. Then, on this 750-ft length, flashboards 2 ft high were added. On the rest of the 1,000-ft length of the spillway, flashboards were added for a height of 6 ft, so that the entire spillway crest was raised a total of 6 ft, to El. 202 instead of El. 196 as originally designed. These flashboards were added subsequently to the resignation in 1907 of Walter H. Sears, M. ASCE, the last Chief Engineer of the Aqueduct Commission.

The designer of the dam and the first chief engineer of the Aqueduct Commission, Alphonse Fteley, M.ASCE, had assumed that El. 202 would be the maximum possible flood level in the reservoir. He called the raising of the spillway crest "injudicious", as mentioned in my previous article, "Danger of Fixed Flashboards Shown by Flood at Croton Dam" (CIVIL ENGINEERING for June 1957, p. 64).

It should be noted that the damage in the 1955 flood occurred in that part of the spillway built in accordance with the original design, with its crest at El. 196, but with a 6-ft height of fixed flashboards added on top. That part with the crest at El. 200, plus a 2-ft height of flashboards, contained more weight because of the four added courses of masonry at the top. No damage was sustained in that part, which was not as high above the foundation as the other.

Photographs of the cracks resulting from the flood were reproduced in *Water Works Engineering* for January 1957. Much of this damage was apparently due to vibration of the spillway and adjacent structures caused by the making and breaking of the vacuum that formed beneath the rapidly moving water as it flowed over the flashboards.

To repair the spillway the reservoir level was drawn down so that the structure could be thoroughly investigated. The New York Department of Water Supply, Gas and Electricity then prepared drawings and specifications for lowering, from El. 200 to 196, the 750-ft length of masonry spillway crest at the far end (farthest from the dam proper) which had originally been raised above the design height. In the course of the work the flashboard standards were removed from the crest, except for the 48-ft length immediately adjoining the dam proper.

Repairs to the spillway were made by drilling 35 holes 140 to 160 ft deep through the masonry and into the bedrock. These holes were then grouted in 20-ft stages under controlled pressure. The success of the repairs is indicated by the fact that since the reservoir has been refilled no leakage has appeared through the damaged portions.

The contract for lowering the spillway crest was let to the Teaco Construction company of the Bronx, New York. The work was in charge of D. J. Tedaldi, at the bid price of about $369,000. The old masonry was cut down from El. 200 to 192.5, and new masonry was put in to replace the old capstones and the step at El. 194.5. Since no blasting was allowed, it was a slow and tedious process, accomplished by drilling into the old masonry and loosening it by wedges, piece by piece. The exposed faces of the old spillway were of granite but the interior was of concrete in which sound stones of various sizes had been embedded.

It was impractical to save the old stone facing for replacement. All cut stone for the new top courses was brought in from a quarry in Massachusetts. The old quarry that had been used by the original contractors, Coleman, Breuchaud and Coleman, had been abandoned. During the operations of the past summer (1958), the water level in the reservoir was kept 8 or 10 ft below the crest by occasional opera-

tion of the three 48-in. blowoffs.

After the 1955 flood an analysis of the stresses in the spillway section was made by the consulting engineers, Malcolm Pirnie and Karl R. Kennison, Members ASCE. This study showed that the lines of force fell outside the middle third of the spillway base when the water level was at its maximum of El. 205.84 during the flood.

The work of removing the top courses of the old masonry was completed toward the end of August 1958, and steps were immediately taken to set the new coping stones with the crest at El. 196 and the second step at El. 194.5. This work was completed in October 1958. The width of crest on the lowered portion is a few feet greater than that on the remainder. John H. Kelly, Engineer for the Eastern District of the Department of Water Supply, Gas and Electricity, is in charge. Edward J. Clark is Chief Engineer.

ENGINEERS' NOTEBOOK

Bending-moment curves for beams with loads varying uniformly from zero

JOSEPH S. GUÉRIN, A.M.ASCE, Head, Engineering Design Office, SCTRH-SCDRN, Port-au-Prince, Haiti

When the load on a beam varies uniformly from zero pressure at a section to w lb per ft at another section, either on the whole span or on part of the span, the bending moment diagram for the zone of the beam where the distributed load occurs is a curve of the third degree. It can be plotted readily as explained below.

Calling A and B the points on the base line of the diagram corresponding to sections A and B where the pressure intensities are respectively w and zero, determine M_A and M_B, the moments at A and B, and the shear V_B at B. Due regard being given to the signs, lay down AJ = M_A, BK = M_B, and with V_B as the slope, draw through K the line Δ which, of necessity, is the tangent to the curve at K. Join JK. Through any section, S, of the beam where the bending moment is to be found, let a line be drawn parallel to AJ and BK, intersecting JK at C. From this point draw a parallel to the line Δ meeting AJ at D. Join DK, which intersects SC at E. From E draw a parallel to the line Δ, cutting AJ at F. The intersection G of FK and SC is a point of the bending-moment curve, and its distance to the base line is the required bending moment. The procedure is illustrated in Figs. 1 and 2.

It is important to keep in mind that the point K, through which the line Δ is to be drawn, corresponds to the section of zero pressure intensity, and that the slope of the line Δ is the shear at this section.

Referring to Fig. 1, and by applying the slope-deflection equations, the following are obtained:

$$M_A = -\frac{wL^2}{20},\ M_B = -\frac{wL^2}{30},$$

$$V_B = -\frac{3\,wL}{20}$$

Taking moments about S, and considering the forces and moment on the right side of the section,

$$M_s = R_B(L-x) - M_B - \frac{w_s(L-x)^2}{6}$$

Noting that $R_B = -V_B = \frac{3\,wL}{20}$ and that $w_s = \frac{w(L-x)}{L}$, after substitution in the above expression for M_s, and simplification, the result is

$$M_s = \frac{w}{2L}\left(\frac{x^3}{3} - Lx^2 + \frac{7L^2x}{10} - \frac{L^3}{10}\right)$$

which is the equation for moment at S.

We will next evaluate GH, having given: AJ $= \frac{wL^2}{20}$, BK $= \frac{wL^2}{30}$, slope of the line $\Delta = \left|\frac{3\,wL}{20}\right|$ and AH $= x$.

We have GH = GC − HC = GE + EC − HC.

Calling N and P respectively the orthogonal projections of C and K on AJ, we get from similar triangles JCN and JKP, $\frac{JN}{JP} = \frac{NC}{PK} = \frac{x}{L}$. From this,

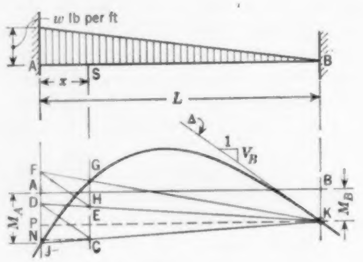


FIG. 1

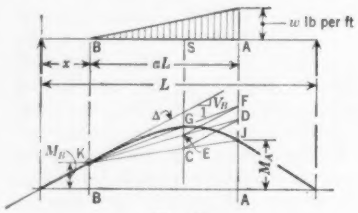


FIG. 2

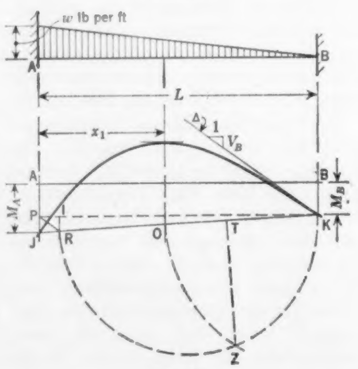


FIG. 3

$JN = \frac{wLx}{60}$, since $JP = AJ - BK = \frac{wL^2}{60}$.

Then $HC = AN = AJ - JN = \frac{wL\,(3\,L - x)}{60}$

Now $\frac{ND}{NC}$ = slope of the line $\Delta = \frac{3\,wL}{20}$.

Hence, $ND = \frac{3\,wLx}{20}$, as $NC = AH = x$.

$$JD = JN + ND = \frac{wLx}{6}$$

By proportionality in the similar triangles KCE and KJD, $\frac{EC}{JD} = \frac{L - x}{L}$. Hence $EC = \frac{wx\,(L - x)}{6}$. Similarly, triangles KGE and KFD give $\frac{GE}{FD} = \frac{L - x}{L}$. Since CDFE is a parallelogram, $FD = EC = \frac{wx\,(L - x)}{6}$.

Then $GE = \frac{wx\,(L - x)^2}{6\,L}$

By substituting the values of GE, EC and HC in the expression for GH, after transformation,

$$GH = \frac{w}{2\,L}\left(\frac{x^3}{3} - Lx^2 + \frac{7\,L^2x}{10} - \frac{L^3}{10}\right)$$

which proves the proposition.

The section of maximum positive moment for the bending moment curve under consideration can be located conveniently by a simple geometrical construction.

Indeed, P being the foot of the perpendicular from K to AJ, determines the point R on JK such that PR is parallel to the line Δ. Call T the third point of JK nearest to K. The section of maximum positive moment intersects JK at a point O such that $(KO)^2 = (KR)\,(KT)$.

Thus, if a semicircle be described on KR as diameter, and a perpendicular to JK at T be made to intersect this semicircle at Z, then KZ = KO.

Proof. This will be given for the case of Fig. 3, which represents the fixed-end beam of Fig. 1, but it can also be established in a similar manner for any other case.

Maximum positive moment occurs when $\frac{dM_s}{dx} = 0$ or $\frac{dM_s}{dx} = \frac{w}{2L}\left(x_1^2 - 2\,Lx_1 + \frac{7\,L^2}{10}\right) = 0$, that is,

$x_1^2 - 2\,Lx_1 + \frac{7\,L^2}{10} = (L - x_1)^2 - \frac{3\,L^2}{10} = 0$, from which $\frac{(L - x_1)^2}{L^2} = \frac{3}{10}$.

By hypothesis, O is taken at the section of maximum positive moment. Its abcissa being x_1, by proportionality,

$$\frac{(L - x_1)^2}{L^2} = \frac{(KO)^2}{(KJ)^2} = \frac{3}{10}.$$

To prove that $(KO)^2 = (KR)\,(KT)$, it now suffices to verify that

$$\frac{(KR)\,(KT)}{(KJ)^2} = \frac{3}{10}.$$

Referring to Fig. 3, it appears that $\frac{RI}{IP}$ = slope of the line $\Delta = \frac{3\,wL}{20}$, I being the foot of the perpendicular from R to KP. Also, by proportionality, $\frac{KI}{RI} = \frac{KP}{JP} = \frac{60}{wL}$, since $KP = L$ and $JP = \frac{wL^2}{60}$ as found previously.

Multiplying these above identities member to member, $\frac{KI}{IP} = 9$, from which $\frac{KI}{KP} = \frac{9}{10}$. But $\frac{KI}{KP} = \frac{KR}{KJ}$, and $\frac{KT}{KJ} = \frac{1}{3}$. Hence $\frac{(KR)\,(KT)}{(KJ)^2} = \frac{3}{10}$.

All-purpose boring rig mounted on "duck"

An amphibian drilling unit has been developed by Soil Testing Services, Inc., of Chicago, Ill., to perform soil borings and investigations for the firm in rivers, lakes, or other bodies of water. It has the advantage of being able to move along a highway and then enter the water, to be driven by propeller to the boring location.

Essentially, the unit consists of an amphibious "duck" manufactured by General Motors Corporation, with a Joy 7 core-drill rig mounted behind the cockpit. The duck has deflatable tires for traversing soft ground and well-constructed pontoons for stability in water. To provide additional stability during the drilling operation, spuds have been welded to each side and to the rear, with provision for raising the duck up on the spuds to develop maximum load transfer to them.

Adjacent to the propeller shaft an 8-in. pipe sleeve is welded on, through which the drilling operation takes place. The upper part of the sleeve is about one foot above the high-water mark when the duck is floating fully loaded. The Joy rig has a hydraulic feed for obtaining undisturbed Shelby-tube samples. The unit is also equipped for vane shear testing and undisturbed piston sampling.

This amphibious unit avoids the tedious operation of assembling and disassembling portable barges for water boring projects or the necessity of securing suitable craft for rental.

This information has been furnished by John P. Gnaedinger, A.M. ASCE, of Soil Testing Services, Inc, Chicago, Ill.

Amphibious "duck" has pontoons for stability in water and deflatable tires for traversing soft ground. It carries a Joy core-drill rig plus equipment for vane shear testing and undisturbed piston sampling.

The gate valve as a flow metering device

W. J. TUDOR, J.M.ASCE, First Lieutenant, Medical Service Corps, Sanitary Engineer, Army Chemical Center, Md.

Any common type of gate valve can be utilized to control the flow rate within ±10 percent once the inside pipe diameter, the valve gate rise, and the accompanying head losses are known.

The energy loss in fluid flow through a gate valve is usually considered, for practical and theoretical reasons, as proportional to the velocity head. Since the flow rate and head loss occur entirely within closed boundaries, the constant of proportionality should depend only on the geometry of the boundary configuration of the gate valve and adjoining piping and also the fluid properties.

Thus, if Q is the flow rate, A_p the area of the pipe and, h_v the head loss due to the gate valve, it follows that

$$\frac{h_v}{V^2/2g} = \frac{h_v}{Q^2/A_p{}^2 2g} = K \ldots (1)$$

where K is the constant of proportionality that is a function of the dimensionless ratios involving the pertinent lengths, areas, volumes, roughnesses, and times and the relevant fluid properties such as density, viscosity or temperature, and degree of turbulence.

Ordinarily K would be expected to be a function of two dimensionless parameters, that is, the ratio between the area of the opening at the gate divided by the area of the pipe and the Reynold's number based on the pipe diameter. However, it was found that for turbulent flow such as that where the Reynold's number is greater than 4,000, K is independent of the Reynold's number. In this case the plotting of K versus the gate area divided by the pipe area only indicates a trend. The dimensionless parameter pd_s/D plotted against K, as shown in Fig. 1, gave the best correlation.

D = inside diameter of pipe
d = height of gate rise
d_s = valve seat diameter
$p = d/d_s \leq 1$

For $pd_s/D < 0.9$ the data are represented by the solid line and the empirical equation,

$$K = \frac{0.45}{\left(\frac{d}{D}\right)^3} = \frac{0.45}{\left(\frac{pd_s}{D}\right)^3} \ldots (2)$$

Combining eqs. 1 and 2 results in

$$Q = \sqrt{\left(\frac{2h_v A_p{}^2 g}{0.45}\right)\left(\frac{pd_s}{D}\right)^3} \ldots (3)$$

For $pd_s/D > 0.9$, the flow no longer goes through a large enough contraction-expansion pattern, from the upstream pipe through the gate opening into the downstream pipe, for K to be still dependent on pd_s/D, and K is represented by the dotted line.

The physical arrangement shown in Fig. 2 should be used in connection with this equation. (To insure a correct measure of d, it is usually necessary to raise the gate to the wide-open position and then lower it to the desired d.)

The turbulence created by the gate valve is higher than can normally be supported by straight pipe friction. This extra turbulence is dissipated in the downstream section of the pipe L, called the settling length (approximately 50 pipe diameters), beyond which the slope of the energy grade-line is again the same as for straight pipe. The head loss, h_v, due to the gate valve is the loss between Sections 1 and 2 for straight pipe with the gate valve minus the loss between Sections 1 and 2 for straight pipe without the gate valve for the same flow rate.

An example solved

Water is flowing in a section of 2-in. pipeline (D = 2.067 in., A_p = 0.0233 sq ft) that has a gate valve (d_s = 1.980 in.) with its gate open wide, and it is desired to decrease the flow to 0.048 cfs (22 gpm). The gate is closed until $p = 0.418$, at which time it is noticed that the total head loss between Sections 1 and 2 is 1.07 ft of water. The head loss between Sections 2 and 3 (equal in length to Sections 1 and 2) is 0.61 ft for straight pipe only. Therefore $h_v = 1.07 - 0.61 = 0.46$ ft of water and

$$Q = \sqrt{\left(\frac{2h_v A_p{}^2 g}{0.45}\right)\left(\frac{pd_s}{D}\right)^3} = \sqrt{\left(\frac{2\ (0.46)\ (0.0233)^2 (32.2)}{0.45}\right)} \times \sqrt{\left(\frac{0.418\ (1.980)}{2.067}\right)^3} = 0.048 \text{ cfs}$$

The writer's experimental work was done at the University of Wisconsin Hydraulics Laboratory while he was an Experimental Station research assistant under the direction of Assoc. Prof. J. R. Villemonte, A.M. ASCE, and appears in an M.S. thesis. The Ladish Company supplied the set of gate valves. The experimental data of Prof. Charles I. Corp and Roland O. Ruble, A.M. ASCE, are from the University of Wisconsin Experimental Station Bulletin Vol. 9, No. 1, 1932. A set of Crane Company valves were used. Sufficient information was not available from other experimenters' work to further the above correlation.

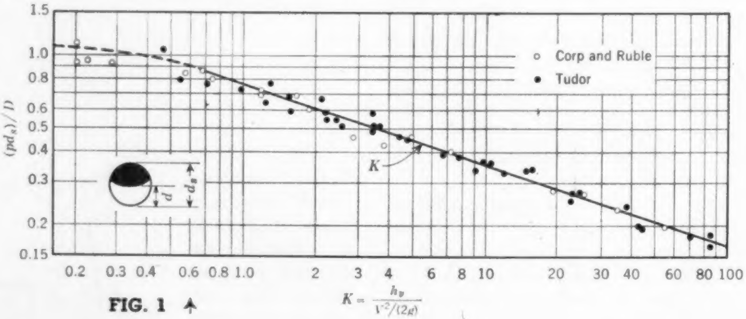


FIG. 1

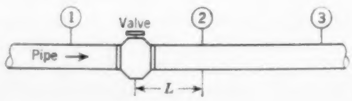


FIG. 2

THE READERS WRITE

Is four years enough for "professional" status?

To the Editor: I attended the session of the Metropolitan Student Council at the recent ASCE Convention in New York. The theme of the meeting was the professional status of the engineer, and much frustration and anguish were displayed over the public's refusal to grant the engineer the status to which he believes himself entitled.

Aside from the general admission that the engineering profession as a whole has done a poor public relations job, I wish to discuss one particular aspect of this subject, that of education and training. The public looks around and sees Joe graduating with a bachelor's degree in order to start apprenticeship as a clerk or handyman in the office of a large corporation. The public takes note of the additional years of training required for medicine, law, and theology.

The retort from engineers that stricter professional licensing requirements would do the job does not hold water as far as the public is concerned. Thus, the young person who graduates from a school of accountancy is generally considered a bookkeeper until he can add C.P.A. after his name. Any ten people selected at random and asked to explain the C.P.A. would reply that it is a degree. They would be amazed to learn that this is a form of professional licensing. This simply means that the public is more sold on the possession of a degree or title and what it stands for than the manner or procedure by which it is acquired. The public only knows that the bachelor's degree is now awarded to many people who are not professional by any stretch of the imagination.

The public knows that the physician studies in college for four years, including a pre-med curriculum, and gets a bachelor's degree, but does not yet have the right to be called a doctor. The lawyer likewise gets a bachelor's degree, but cannot yet call himself a lawyer. Yet the engineer studies for four years in college, including an engineering curriculum (not a pre-engineering program), gets his bachelor's degree, and then yells bloody murder because the public hesitates to grant him full professional status.

As an example of the trend, most of the finishing students this past year in the field of sanitary engineering acquired a master's degree, and it is entirely possible that in another 15 years three of every four students specializing in sanitary engineering will acquire a graduate degree.

This is professional! This is what the public looks for and expects because, relatively speaking, anyone these days can get a bachelor's degree!

Israel Light, *Information Officer*
Eng. Resources Program
Div. of Sanitary Eng. Services
U.S. Public Health Service

Washington, D. C.

Another method of traverse closure

To the Editor: Mr. John F. Tanner shows an excellent method of traverse closure in the November issue, p. 76. His Case 3, "Two closing sides with an unknown distance and an unknown bearing" can be conveniently solved as follows:

1. Rotate all bearings such that the course of the unknown distance becomes due north, south, east or west. (Assume west for the explanation of problem.)

2. Latitudes and departures are now calculated for the rotated bearings.

3. As the course of unknown distance now has no latitude, the difference of north-south latitudes will all be for the course of unknown bearing.

4. The unknown bearing can now be determined by functions having the latitude and known distance.

5. The departure of the course of known bearing can be determined by functions.

6. The difference of east-west departures will now be for the course of unknown distance and this will be the calculated distance.

7. The two unknowns are now determined. As a check, the latitudes and departures can be added up, using the original bearings, for a closure. A scaled drawing is often helpful for this calculation.

This procedure is applicable also to Mr. Tanner's Case 2, "Two closing sides with two unknown distances."

Leroy Martin, M. ASCE
Owner, AAA Engineering Co.

Hayward, Calif.

How many bridge panels in Chenghwa truss?

To the Editor: I found the article by Dr. P. H. Cheng, on the Chenghwa truss (p. 58 of the November 1958 issue), extremely interesting. However, I believe the claim of spanning a 210-ft gap with only 172 Bailey bridge panels to be in error.

Since the bridge is formed of four trusses, there would be 43 panels per truss. Each panel is 10 ft long. The span, being 210 ft, requires 21 panels to form the lower cord. This would leave only 22 panels to form the upper cord and the vertical struts. As near as I could determine, a closer figure would be 53 panels per truss, or a total of 212 panels for the whole bridge. In addition, there are special connecting devices for the upper cord and diagonal tension members which were not included in the comparison of dead weight versus carrying capacity.

Robert A. Cattley, J. M. ASCE
2nd Lt. Corps of Engineers

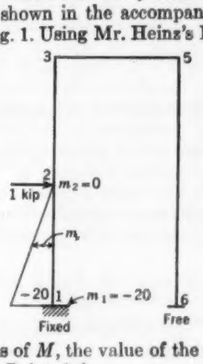
Fort Campbell, Ky.

Simplest virtual force system

To the Editor: In the article on "Simplified Deflection Calculations by Virtual Work", by Elwood Heinz (November issue, p. 73), the emphasis seems to be on the numerical work rather than on the character of the virtual force system. It is not evident whether the author was introducing a virtual force system that would illustrate his numerical arrangement more fully or whether he was unaware that a simpler virtual force system can be applied to the frame.

The virtual force system is, of course, independent of the constraints in the actual force system and should be the simplest statically determinate force system that will give the desired displacement. It should never be a statically indeterminate force system. The only requirement is that the external work due to the virtual forces must involve the actual displacement as the only unknown. In the numerical example that Mr. Heinz used, the simplest virtual force system would be the one shown in the accompanying diagram, Fig. 1. Using Mr. Heinz's Eq. 4 and

FIG. 1



his values of M, the value of the displacement at Point 2 is

$$\frac{20}{3\,EI}\left[(-75.2)\,(-20) + \frac{(-9.2)\,(-20)}{2}\right] = \frac{10{,}640}{EI}$$

L. C. Maugh, M. ASCE
Prof. of Civil Eng.
University of Michigan

Ann Arbor, Mich.

More about bridge geometrics by computer

TO THE EDITOR: In his article in the May 1958 issue, "Solving Bridge Geometrics by Computer," Mr. Belzer offered an equation which closely approximates the solution to the problem of determining the intersection of a straight line with a spiral curve. Unfortunately, the accuracy of the results obtained by the proposed formula is not consistent with the more precise spiral factors given in *Transition Curves for Highways* by Barnett. Although such comparatively minor discrepancies are of little importance in field layout, they can be particularly annoying in developing detailed office calculations for interchange alignments.

I believe Mr. Belzer has made the problem both more difficult and less accurate by departing from the use of the Barnett tables when, in fact, an equation can be formulated which not only conforms to the theoretical requirements of a true highway spiral but offers full accuracy to at least two decimal places and ease of solution as well. Such an equation takes the form, $y' - mx' =$

$$\frac{\sqrt{\theta_s}}{l_s}\left[\Delta R\,(\cos\theta + m\sin\theta) + b\right]\frac{1}{\sqrt{\theta}}$$

where y' is the sum of the series,

$$\left[\frac{a\theta}{3} - \frac{(a\theta)^3}{7(3!)} + \frac{(a\theta)^5}{11(5!)} - \ldots\right]$$

and x' is the sum of the series,

$$\left[1 - \frac{(a\theta)^2}{5(2!)} + \frac{(a\theta)^4}{9(4!)} - \ldots\right]$$

where $a = \dfrac{\pi}{180}$ and θ are expressed in degrees.

For most spirals, use of the first two terms of both series provides sufficient accuracy, but since little additional work is required, the use of the first three terms is recommended. This equation presents no serious obstacle to solution by electronic computers and is materially easier for the engineer who must make a manual solution inasmuch as the sums of x' and y' correspond to the values of x and y respectively given in the Barnett tables for various values of θ.

I might also point out that in Eq. 7 of Mr. Belzer's paper, the s^2 term should be negative and the y/m term should be y_1/m.

KEITH A. KELLY, A.M. ASCE
Chief Engr., Baker-Wibberley & Assocs., Inc.

Baltimore, Md.

Author replies

TO THE EDITOR: I wish to thank Mr. Kelly for pointing out the two typographical errors in Eq. 7 of my article in the May issue, p. 52. He is also correct in his observation that the formulas of my article may, under certain circumstances, lead to inaccuracies in results. The approximation $\theta = \sin\theta$, employed in the derivation of the equations, limits their use to small-angled spirals. The corresponding theory for larger angles has been developed by the writer and is being incorporated in a computer program supplementary to the one described in the article. Details are being readied for publication.

Since Mr. Kelly's description of his formulas is very brief, and contains no derivations, I find it difficult to tell how well this theory conforms to the theoretical requirements of a true highway spiral, nor can I tell how readily they lend themselves to finding the stations for each point. I would like to point out that the purpose of my article was to describe a computer program to mechanize the computation of geometrics of bridges, thereby eliminating manual calculations and the use of tables.

While reviewing my article I discovered an error in Eq. 2 (*b*). This should read:

$$X = \int_0^s \sqrt{1 - \frac{S^4}{L^2\,(L^2 + 4\,R^2)}}\;ds$$

JACK BELZER
Consultant, Systems Eng. Div.
Battelle Memorial Inst.

Columbus, Ohio

Deflection of variable-section cantilever beams

TO THE EDITOR: The following formulas—in the form of tables containing coefficients of the r terms—are offered as a check on the deflections of cantilever beams with variable section presented by Thomas D. Y. Fok in the October 1958 issue. For convenience, the r values are here taken as the reciprocals of those in the Fok formulas, that is, $r_a = \frac{1}{2}$ instead of 2; $r_b = \frac{2}{3}$ instead of 1.5; and so on.

With the beam divided into ten equal parts (Fig. 1), the deflection at B due to the load P (= 100 kips) is

$$y_{10} = \frac{P(L)^3}{1{,}000\,EI}\,(48.3\,r_0 + 81\,r_1 + 64\,r_2 + 49\,r_3 + 36\,r_4 + 25\,r_5 + 16\,r_6 + 9\,r_7 + 4\,r_8 + r_9)$$

Letting $r_0 = r_1 = r_2 = r_3 = \frac{1}{2}$; $r_4 = r_5 = r_6 = r_7 = \frac{2}{3}$; $r_8 = r_9 = 1$; and noting that $E = 30{,}000$, $I = 3960$ in^4., we get

$$y_B = \frac{100\,(90)^3}{1{,}000 \times 30{,}000 \times 3960}\,(242.3 \times \tfrac{1}{2} + 86 \times \tfrac{2}{3} + 5 \times 1) = 0.113 \text{ in.}$$

Also, if we imagine the half-beam divided into ten equal parts, the deflection at Point 5 due to load Q (= 100 kips) at Point 5, is

$$y_5 = \frac{Q\,(\frac{1}{2}L)^3}{1{,}000\,EI}\,(48.3\,r_0 + 81\,r_1 + 64\,r_2 + 49\,r_3 + 36\,r_4 + 25\,r_5 + 16\,r_6 + 9\,r_7 + 4\,r_8 + r_9).$$

Letting r_0 through $r_7 = \frac{1}{2}$; $r_8 = r_9 = r_{10} = \frac{2}{3}$ (the coefficient of r_{10} being practically zero), we have

$$y_5 = \frac{100\,(45)^3}{1{,}000 \times 30{,}000 \times 3960}\,(328.3 \times \tfrac{1}{2} + 5 \times \tfrac{2}{3}) = 0.013 \text{ in.}$$

Since the deflection at C due to the load P at B equals $y_B + \theta_b \times b$; it also follows that the deflection at B due to the load Q at point 5 equals $y_5 + \theta_5 \times (\frac{1}{2}L)$; where the θ's are angular rotations.

Accordingly, we have

$$y_5 = \frac{Q\,(\frac{1}{2}L)^2}{1{,}000\,EI}\,(49\,r_0 + 90\,r_1 + 80\,r_2 + 70\,r_3 + 60\,r_4 + 50\,r_5 + 40\,r_6 + 30\,r_7 + 20\,r_8 + 11\,r_9) \times (\tfrac{1}{2}L) =$$

$$\frac{100\,(45)^3}{1{,}000 \times 30{,}000 \times 3960}\,(469 \times \tfrac{1}{2} + 31 \times \tfrac{2}{3}) = 0.020 \text{ in.}$$

Then the total deflection at B due to both P and Q = 0.113 + 0.013 + 0.020 = 0.146 in. (Value by Fok = 0.1535 in.)

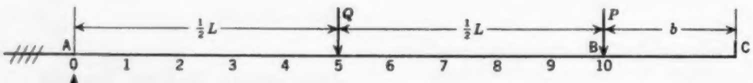
The deflection at B due to full uniform load of 5 kips per foot (5/12 kips per inch) is

$$y_{10} = \frac{(5/12)\,(90)^4}{1{,}000 \times 30{,}000 \times 3960}\,(23.2\,r_0 + 36.6\,r_1 + 25.7\,r_2 + 17.2\,r_3 + 10.9\,r_4 + 6.3\,r_5 + 3.2\,r_6 + 1.4\,r_7 + 0.4\,r_8 + 0.1\,r_9) =$$

$$\frac{2{,}733.75}{30{,}000 \times 3960}\,(102.7 \times \tfrac{1}{2} + 21.8 \times \tfrac{2}{3} + 0.5 \times 1) = 0.0153 \text{ in. (Value by Fok} = 0.01603 \text{ in.)}$$

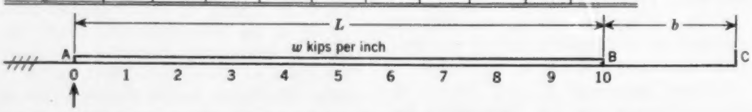
T. F. HICKERSON, M.ASCE
Formerly Prof. of Civil Eng., Univ. of North Carolina

Chapel Hill, N. C.



y_{10}	48.3	81	64	49	36	25	16	9	4	1	333.3
θ_B	49	90	80	70	60	50	40	30	20	11	500

FIG. 1



y_{10}	23.2	36.6	25.7	17.2	10.9	6.3	3.2	1.4	0.4	0.1	125.0
θ_B	23.8	40.6	32.0	24.5	18.0	12.6	8.0	4.5	2.0	0.6	166.6

Los Angeles Convention

Statler-Hilton Hotel, Los Angeles, Calif. **February 9-13, 1959**

ADVANCE INFORMATION ON ATTENDANCE

To help the committee provide for your attendance at the Convention, please let them know of your plans to attend. On page 118 of this issue is a coupon for this purpose. This is not preregistration. It does not require any payment in advance. Your cooperation in sending in the coupon will be of assistance in making this a better convention for all concerned.

HOTEL ACCOMMODATIONS

Headquarters for the Los Angeles Convention will be the Statler-Hilton Hotel, on Wilshire Boulevard, in Los Angeles. Arrangements have been made to house Convention visitors at the headquarters hotel to the limit of space in the order that reservation requests are received. To assure facilities at the Statler, send in your reservation request early. To assist you, a coupon is included in this issue on page 118, to be sent directly to the headquarters hotel.

REGISTRATION

Hotel Statler-Hilton, Lobby

Opens Sunday, Feb. 8, 2:00 p.m. to 5:00 p.m.

Monday through Friday, 8:00 a.m. to 5:00 p.m.

Fee $5.00 (except women and students.)

AUTHORS' BREAKFASTS

Statler-Hilton Hotel **Mission Room**

7:45 a.m. Monday through Thursday

Briefing sessions for speakers, discussers and program officials for each day will take place at a breakfast meeting on the morning of that day. Attendance is by invitation only.

Presiding: George E. Brandow, Chairman, Technical Program Committee

ICE-BREAKER PARTY

Monday, Feb. 9 **5:30-7:00 p.m.**

Pacific Ballroom **Statler-Hilton Hotel**

Congenial conversation, entertainment and cocktails.

At this first general gathering of the Convention, the cordial hospitality of the Los Angeles Section will be enjoyed. All who have paid the registration fee, and their wives, are welcome without charge.

PACE SETTING LUNCHEON

Mon., Feb. 9 **Pacific Ballroom**

Presiding: Francis S. Friel, President ASCE

Chairman: Robert Skinner, President, Los Angeles Section, ASCE.

All members, guests and friends of the Society are invited to attend, sharing topics of timely concern to the profession.

Tickets for this event must be purchased before 10:00 a.m. on Monday.

MONDAY MORNING

FEB. 9

Hydraulics Division

9:45 a.m. **Garden Room E**

9:45 Introductory Remarks
Norman H. Brooks, Assoc. Prof. of Civil Eng., Calif. Inst. of Tech., Pasadena.

10:15 An Investigation of Artificial Stimulation of the Turbulent Boundary Layer in Outlet Works
R. G. Cox, Chief, Analysis Section, U. S. Waterways Experiment Station, Vicksburg, Miss.; and F. L. Bauer, Captain, Corps of Engineers, U. S. Army, Germany.

10:45 The Effect of a Longitudinal Velocity Gradient on the Drag Coefficient for Circular Cylinders
Frank D. Masch, Instructor, and Walter L. Moore, Prof. of Civil Eng.; University of Texas, Austin.

11:15 Experiments on the Settling of Flocculent Suspensions
Ronald T. McLaughlin, Research Fellow in Civil Eng., Calif. Inst. of Tech., Pasadena.

Surveying and Mapping Division

9:45 a.m. **Los Angeles Room**

9:45 Classical Methods of Field Mapping
Fred T. Willoughby, Los Angeles Office, Corps of Engineers.

10:15 Modern Photogrammetric Mapping Techniques
H. Rasnow and A. Cocking, Aerial Control, Inc.

10:45 Simulated Photographic Mapping Flight (Society of Photographic Instrumentation Engineers)

11:45 Stereo Plotting
F. W. Pafford, Pafford & Assoc.

11:45 Automation of the Compilation Process

MONDAY AFTERNOON

FEB. 9

Air Transport and City Planning Divisions

2:30 p.m. **Sierra Room**

Development of the Los Angeles Airport

2:30 Existing Air Traffic and Trends
K. A. Osterberg, Financial Consultant, Aviation Services, Minneapolis, Minn.

3:00 Architectural Planning and Treatment of Airport Problems
D. E. Wilcox, Project Manager, Joint Venture, Los Angeles.

4:00 **Civil Engineering Features of the Development**
O. G. JOHNSON, Project Manager, Joint Venture, Los Angeles.

Construction and Power Divisions

2:30 p.m. Golden State Room

2:30 **Design of Glen Canyon Dam**
LOUIS G. PULS, Chief Designing Engr., Bureau of Reclamation. (30-min. color film showing construction of dam)

3:30 **Construction Plant for Glen Canyon Dam**
JOSEPH PERANIO, Chief Engr., Merritt-Chapman & Scott Corp.

4:15 **Construction of Colorado River Bridge at Glen Canyon Dam**
FRANCIS J. MURPHY, Project Mgr., Kiewit-Judson Pacific Murphy.

Hydraulics and Waterways and Harbors Divisions

2:30 p.m. Garden Room E

2:30 **The Los Angeles Flood Control Program**
CARROLL T. NEWTON, Dist. Engr., Corps of Engrs., Los Angeles; and HAROLD E. HEDGER, Chief Engr., Los Angeles County Flood Control Dist., Los Angeles.

3:15 **Effect of Reservoir Regulation on the Regimen of River Channels Downstream Therefrom**
JOSEPH F. FRIEDKIN, Principal Engr., International Boundary Commission, El Paso, Tex.

4:00 **Surveys of Mountain Snow Fields by Aerial Reconnaissance**
WALTER J. PARSONS, JR., Chief, Hydrology Section, and GLENN H. CASTLE, Hydrology Section; Corps of Engrs., Sacramento Dist., Sacramento, Calif.

Structural and Eng. Mechanics Divisions

2:30 p.m. Garden Room W

2:30 **Properties of Steel and Concrete and the Behavior of Structural Members**
GEORGE WINTER, Head, Dept. of Structural Eng., Cornell Univ.

3:00 **Plastic Design in Steel**
FREDERICK W. SCHUTZ, JR., Prof. of Civil Eng., Georgia Inst. of Tech., Atlanta.

3:30 **Status of Plasticity in Structural Concrete Design**
BORIS BRESLER, Univ. of Calif., Berkeley.

4:00 **Plasticity—Factor in Timber Design**
BEN BENIOFF, Partner, King Benioff & Assocs., Consulting Engrs., Sherman Oaks, Calif.

Surveying and Mapping Division

2:30 p.m. Los Angeles Room

2:30 **The Status of Education in the Field of Surveying and Mapping**
R. C. BRINKER, Prof. of Civil Eng., Texas Western College, El Paso.

3:15 **Recent Advances in the Field of High-Precision Photogrammetric Mapping Methods**

4:00 **Application of Digital Techniques to Photogrammetric Processes**
B. S. BENSON, Benson-Lehner Corp., Los Angeles.

TUESDAY MORNING

FEB. 10

Hydraulics Division

8:45 a.m. Garden Room E

8:45 **Delta Formations in Reservoirs**
A. S. HARRISON, Hydraulic Engr., Corps of Engineers, Omaha Dist., Omaha, Nebr.

9:30 **Erosion Control on Southeastern Arizona's San Simon Creek**
G. H. LIPSCOMB, State Agricultural Engr., U. S. Bur. of Land Management, Phoenix, Ariz.

10:15 **Sediment Problems on the Lower Colorado River**
W. M. BORLAND, Head, Sedimentation Sect., U. S. Bur. of Reclamation, Denver, Colo.

Highway and City Planning Divisions

8:45 a.m. Assembly Room

8:45 **Planning for Transportation Systems in Urban Areas**
HARMER E. DAVIS, Director, Inst. of Transportation and Traffic Eng., Univ. of Calif.

9:15 **Planning for Seattle Freeway**
W. A. BUGGE, Director, Washington Dept. of Highways.

9:45 **The Role of Mass Transit in Urban Areas**
GEORGE W. ANDERSON, Exec. Vice President, American Transit Assoc., New York, N. Y.

10:15 **Transportation Planning Studies in the Metropolitan San Diego Area**
EDWARD M. HALL, Transportation Research Director, City of San Diego, Calif.

Soil Mechanics and Foundations Division

8:45 a.m. Los Angeles Room

8:45 **Governmental Cooperation on Landslide Investigations**
R. R. ROWE, Principal Bridge Engr., State Div. of Highways, State of Calif.

9:15 **Municipal Problems in Landslide Areas**
L. A. PARDEE, City Engr., Dept. of Public Works, Los Angeles.

9:45 **Geological Aspects of the Pacific Palisades Landslides**
JOHN T. MCGILL, Dept. of Geology, U.C.L.A.

10:15 **Soil Mechanics Aspects of the Pacific Palisades Landslides**
J. P. GOULD, Associate, Moran, Proctor, Mueser and Rutledge, New York, N. Y.

Structural and Eng. Mechanics Divisions

8:45 a.m. Garden Room W

8:45 **Ultimate-Strength Design of Reinforced Concrete**
PHIL M. FERGUSON, Prof. of Civil Eng., Univ. of Texas, Austin.

9:15 **Practical Design Considerations**
RICHARD R. BRADSHAW, Consulting Structural Engr., Van Nuys, Calif.

9:45 **Examples of Structures Designed by Ultimate-Strength Theory**
ROBERT A. SHOOLBRED, Regional Structural Engr., Portland Cement Assoc., Atlanta, Ga.

10:15 **Limit Design, Its Development and Its Place in Future Structural Concrete Design Practice**
ALAN H. MATTOCK, Development Engr., Portland Cement Assoc., Chicago, Ill.

Waterways and Harbors and Power Divisions

8:45 a.m. Sierra Room

8:45 **Subsidence in the Port of Long Beach**
R. F. Berbower, Asst. Chief Harbor Engr., City of Long Beach Harbor Dept.

9:15 **Port Structures in Long Beach Harbor**
R. N. Hoffmaster, Chief Harbor Engr., City of Long Beach Harbor Dept.

9:45 **Surface Subsidence and Remedial Measures at the Long Beach Naval Shipyard**
Charles H. Neel, CEC, USN, Public Works Office, Long Beach Naval Shipyard.

10:15 **Recent and Future Construction in Los Angeles Harbor**
Clinton C. Dockweiler, CEC, USN, (Ret.), Chief Harbor Engr., Los Angeles Harbor Dept.

Conditions of Practice Dept., Employment Conditions Committee

11:00 a.m. Garden Room E

Engineers and Unions—California Report

William W. Moore, Partner, Dames & Moore

Arnold Olitt, Partner, Woodward, Clyde, Sherard & Assocs.

Jack Y. Long, Partner, J. Y. Long Co., Engineers.

TUESDAY AFTERNOON

FEB. 10

Highway and City Planning Divisions

2:30 p.m. Assembly Room

2:30 **Freeways in Urban Planning**
Harold M. Lewis, City Planner and Consulting Engr., former Chief Engr. of Regional Plan Assoc., New York, N. Y.

3:00 **Symposium on Plan for Freeways in California**

This discussion will cover scope and methods of developing the report and overall plan for freeways in California, which have been presented to the current session of the State Legislature.

J. W. Vickrey, Deputy State Highway Engr., and M. H. West, Principal Highway Engr., Calif. Div. of Highways, Sacramento.

4:00 **A Plan for a County Motor Vehicle Transportation System**
Victor W. Sauer, Public Works Director, Contra Costa County, Calif.

Hydraulics Division

2:30 p.m. Garden Room E

2:30 **Application of Hydrology to the Protection of Small Watersheds in California**
Harold C. Enderlin, State Conservation Engr., Soil Conservation Service, U. S. Dept. of Agriculture, Berkeley, Calif.

3:00 **The Hydrology of Stock-Water Reservoirs in Upper Cheyenne River Basin**
Richard C. Culler, Project Hydrologist, U. S. Geological Survey, Denver, Colo.

3:30 **Cooperative Water-Yield Procedures Study and Some Problems Encountered**
A. L. Sharp, Supervisory Hydraulic Engr., Agricultural Research Service; A. E. Bibbs, Hydr. Engr., U. S. Bur. of Reclamation; W. J. Owen, Hydr. Engr., Soil Conservation Service; U. S. Dept. of Agriculture, Lincoln, Nebr.

4:00 **Watershed Treatment Projects in the San Gabriel Mountains of Los Angeles County**
William R. Ferrel, Supervising Civil Engr., Los Angeles County Flood Control Dist.

AWARDS LUNCHEON

Tuesday, Feb. 10

12:30 p.m. Pacific Ballroom

Speaker: Lee A. Du Bridge, President, Calif. Inst. of Tech.

Subject: The University's Role in Engineering Research

Presiding: Francis S. Friel, President, ASCE.

Chairman: Samuel B. Morris, Vice President, ASCE.

Research Awards: Arthur T. Ippen, Chairman, Committee on Research

All members, guests and friends of the Society are invited to attend.

Tickets for this event must be purchased before 10:00 a.m. on Tuesday.

Irrigation and Drainage Division

2:30 p.m. Los Angeles Room

2:30 **Los Angeles Water Supply and Irrigation Development**
Samuel B. Morris, Vice President ASCE, Consulting Engr., Los Angeles Dept. of Water and Power.

3:30 **Importation of Water from Colorado River to Southern California by Metropolitan Water Dist. of Southern Calif.**
R. B. Diemer, Gen Mgr. and Chief Engr., Metropolitan Water Dist.

Structural and Engineering Mechanics Divisions

2:30 p.m. Garden Room W

2:30 **Plastic Redistribution of Moments in Reinforced Concrete Beams**
Douglas T. Wright, Prof. of Civil Eng., Waterloo College, Ontario, and Carl Berwanger, Lecturer in Civil Eng., Univ. of Manitoba, Winnipeg, Canada.

3:00 **Strength of Slender Restrained Reinforced Concrete Columns**
Bengt Broms, Engr., Exploration & Production Research Div., Shell Development Co., Houston; and Ivan M. Viest, Bridge Research Engr., AASHO Road Test, Ottawa, Ill.

3:30 **Design Considerations for Fatigue in Timber Structures**
Wayne Lewis, Engr., Forest Products Lab., U. S. Dept. of Agriculture, Madison, Wis.

4:00 **Inelastic Considerations in Timber Design**
H. J. Degenkolb, Partner, Gould & Degenkolb, Consulting Engrs., San Francisco, Calif.

TUESDAY EVENING ENTERTAINMENT

7:00 to 10:00 p.m.

A Men's Smoker will be held in the Pacific Ballroom

A Women's Puffer will be held in the Golden State Room

WEDNESDAY MORNING

FEB. 11

Hydraulics and Power Divisions

8:45 a.m. Garden Room E

8:45 **The Hydraulic Design of Slotted and Solid Buckets for High, Medium, and Low Dam Spillways**
Glenn L. Beichley and Alvin J. Peterka, Hydr. Engrs., U. S. Bur. of Reclamation, Denver, Colo.

9:30 **Bucket-Type Energy Dissipators**
Fred R. Brown, Chief, Hydrodynamics Branch, and Gloria P. Roberts; U. S. Waterways Experiment Station, Vicksburg, Miss.

10:15 **Operational Limitations on Flip Bucket Design**
Rex A. Elder, Head, Hydraulic Lab., TVA, Norris, Tenn.

Irrigation and Drainage Division

8:45 a.m. Los Angeles Room

8:45 **Feather River Project—Alternate Routes, Economic Studies**
Harvey O. Banks, Director, Div. of Water Resources, Calif.

9:25 **Upstream Watershed Management, Los Angeles River**
M. R. Howlett, Engr., U. S. Forest Service.

10:05 **Progress Report on Fresh Water Barrier to Prevent Salt Water Intrusion**
Arthur E. Burington, Engr., Los Angeles County Flood Control District.

Sanitary Engineering Division

8:45 a.m. Golden State Room

8:45 **Evaluation of the Necessity for an Atmospheric Control Program**
Walter L. Hamming, Director of Air Analysis, L. A. County Air Pollution Control Dist.

9:25 **The Role of the State of California in the Control of Atmospheric Pollution**
John A. Maga, Chief Bur. of Air Sanitation, Calif. Dept. of Public Health.

10:05 **Control Aspects of Pollution in Los Angeles County**
Robert A. Chass, Director of Eng., Los Angeles County Air Pollution Control Dist.

10:45 **Recent Advances in the Control of Atmospheric Pollution**
W. L. Faith, Managing Director, Air Pollution Foundation, San Marino, Calif.

Structural and Engineering Mechanics Divisions

8:45 a.m. Garden Room W

8:45 **Equilibrium Method of Design**
Ralph E. Boeck, Prof. of Civil Eng., Marquette Univ., Milwaukee, Wis.

9:15 **Mechanism Method of Design**
Edward R. Estes, Jr., Resident Engr., Amer. Inst. of Steel Construction, New York, N. Y.

9:45 **Connections**
George C. Driscoll, Jr., Resident Asst. Prof. in Civil Eng., Fritz Eng. Lab., Lehigh Univ., Bethlehem, Pa.

10:15 **Examples of Plastically Designed Structures and Specifications**
Theodore R. Higgins, Director of Eng. and Research, Amer. Inst. of Steel Construction, Inc., New York, N. Y.

Waterways and Harbors Division

8:45 a.m. Sierra Room

8:45 **Breakwaters in the Hawaiian Islands**
R. Q. Palmer, Chief, Planning and Reports Branch, U. S. Army Engineers, Honolulu, Hawaii.

9:30 **The Crescent City Breakwater, Calif.**
John A. Deignen, Chief, Eng. Div., U. S. Army Engineer Dist., San Francisco, Calif.

10:15 **The Rincon Offshore Island and Open Causeway**
John A. Blume, President, and James M. Keith, Project Engr.; John A. Blume and Associates, San Francisco, Calif.

Conditions of Practice Dept., Eng. Education Committee

11:00 a.m. Garden Room E

Cooperation of Industry and Education

What Does Industry Expect From the Schools?
Ford Dickerhoff, Director of Personnel, Hughes Aircraft Co.

What Do the Schools Expect From Industry?
Robert E. Kelly, Assoc. Supt. in Charge of Secondary Education, L. A. City Schools.

INDUSTRY—EDUCATION LUNCHEON

Wednesday, Feb. 11

12:30 p.m. Pacific Ballroom

Speaker: Admiral Charles F. Horne, Vice President, Convair Corp.

Presiding: Francis S. Friel, President ASCE.

Chairman: Trent R. Dames, General Convention Chairman.

All members, guests and friends of the Society are invited to attend.

Tickets for this event must be purchased before 10:00 a.m. on Wednesday.

HIGHWAY DIVISION FIELD TRIP

Freeways

9:30 Assembly Room

A briefing session on the status of development of freeways in the Los Angeles area and construction projects under way will be conducted by the California Div. of Highways, Dist. VII; E. T. Telford, Asst. State Highway Engr.; L. R. Gillis, Dist. Engr., and A. L. Himmelhoch, Dist. Engr.

10:30 **Buses will leave the Statler Hotel**
A tour of going construction projects and completed sections of freeways in the metropolitan area, including the harbor, Santa Ana, Golden State, Ventura, San Diego and Hollywood. There will be approximately 14 projects under construction on these freeways, involving over $80,000,000 in construction cost. Arrangements will be made for brief stops with an explanation of current items under way.

4:00 **Buses will return to the Statler**
Arrangements will be provided for a group luncheon en route.
Tickets for this tour must be purchased before 5:00 p.m. on Tuesday, Feb. 10.

WEDNESDAY AFTERNOON

FEB. 11

Hydraulics Division

2:30 p.m. Garden Room E

2:30 Analyses of Backwater in Tidal Channels
GLENN R. PETERSON, Assoc. Hydraulic Engr., Dept. of Water Resources, State of Calif.

3:15 San Francisco Siltation Investigation
HAYWOOD G. DEWEY, JR., Chief, San Francisco Bay Section, Corps of Engrs., San Francisco Dist., San Francisco, Calif.

4:00 Tracing Sediments in San Francisco Bay by Radioisotopes
RAY B. KRONE, Research Engr., Inst. of Eng. Research, Univ. of Calif., Berkeley.

Power Division

2:30 p.m. Mission Room

2:30 Cooling-Water Supplies for California Steam-Electric Stations on Tidewater
R. W. SPENCER, Manager, Eng. Dept., and JOHN BRUCE, Exec. Asst.; Southern Calif. Edison Co., Los Angeles.

3:30 Generation of Power from Geothermal Steam at Geysers Power Plant
BEN C. ALBRITTON, Senior Civil Engr., and ALBERT W. BRUCE, Supervising Mech. Engr.; Pacific Gas & Electric Co., San Francisco, Calif.

4:30 Ocean Cooling-Water Systems for the Scattergood and Haynes Plants and Related Construction and Dewatering Problems
WILLIAM A. HUNSUCKER, Senior Structural Engr., and L. T. MARINER, Engr. of Admin. and Eng. Services; Dept. of Water and Power, City of Los Angeles, Calif.

Structural and Engineering Mechanics Divisions

2:30 p.m. Garden Room W

2:30 Stability Problems in Plastic Design
ROBERT L. KETTER, Prof. and Head of Civil Eng., Univ., of Buffalo, Buffalo, N. Y.

3:00 Deflection Stability of Frames under Repeated Loads
EGOR P. POPOV, Prof. of Civil Eng., Univ. of Calif., Berkeley; and ROBERT E. MCCARTHY, JR., Engr., McCarthy Tank & Steel Co., Bakersfield, Calif.

3:30 Dynamic Response of Elasto-Plastic Frames
JOSEPH PENZIEN, Assoc. Prof. of Civil Eng., Univ. of Calif., Berkeley.

4:00 Dynamic Design in the Plastic Range
HANS H. BLEICH, Director, Inst. of Flight Structures, Columbia Univ., New York, N. Y.; and MELVIN L. BARON, Chief Engr., P. Weidlinger, Consulting Engr., New York, N. Y.

WEDNESDAY EVENING

ENTERTAINMENT

Trip to Disneyland

THURSDAY MORNING

FEB. 12

Highway Division

8:45 a.m. Assembly Room

8:45 The Use of Traffic Models in Estimating and Forecasting Travel
ALAN M. VOORHEES, Traffic Planning Engr., Automotive Safety Foundation, Washington, D. C.

9:15 Driver Needs in Freeway Signing
GEORGE M. WEBB, Engr., Calif. Div. of Highways, Sacramento, Calif.

9:45 Traffic Characteristics and Phenomena on High-Density Controlled-Access Facilities
ADOLPH MAY, JR., Assoc. Prof. of Civil Eng., Highway Traffic Safety Center, Michigan State Univ.

Power Division

8:45 a.m. Mission Room

8:45 Control of Cracking in TVA Masonry Dams
WALTER F. EMMONS, Head Civil Engr., OLAV LAVIK, Civil Engr., and PAUL L. HORNBY, Civil Engr.; Tennessee Valley Authority, Knoxville, Tenn.

10:00 High-lift Construction Methods for Mass Concrete
OTTO HOLDEN, Chief Engr., the Hydro-Electric Power Commission of Ontario, Toronto, Canada.

Construction Division

8:45 a.m. Garden Room E

8:45 Design of Ballistic Missile Facilities by the Air Force Ballistic Missile Division
WILLIAM D. ALEXANDER, USAF.

9:30 Construction of Air Force Ballistic Missile Facilities by the Corps of Engineers
WILLIAM L. BARNES.

FIELD TRIP

Hydraulics and Irrigation and Drainage Divisions

8:45 Leave Statler by bus
Major points of interest: West Coast Basin Barrier Project, Redondo Beach Recharge Project, Rio Hondo Coastal Basin Spreading Grounds, lunch (Pico area), Whittier Narrows Dam, Sawpit Debris Basin, Eaton Dam and Spreading Grounds.

3:30 Return to Statler
Tickets for this tour must be purchased before 5:00 p.m. on Wednesday, Feb. 11.

Soil Mechanics and Foundations and Structural Divs.

8:45 a.m. Garden Room W

8:45 Earthquakes and Their Behavior
HUGO BENIOFF, Seismological Lab., Calif. Inst. of Tech., Pasadena.

9:45 Geography of Earthquake Risks
C. F. RICHTER, Seismological Lab., Calif. Inst. of Tech., Pasadena.

Waterways and Harbors and City Planning Divisions

8:45 a.m. Sierra Room

8:45 Planning and Development of Small-Craft Harbors
JAMES DUNHAM, Chief Engr., Calif. Div. of Small Craft Harbors, Sacramento.

9:15 Plan for Sand Bypassing in Ventura County
W. J. HERRON, Chief, River and Harbor Planning Sect., U. S. Army Engr. Dist., Los Angeles.

9:45 Forces on Cylinders in Constant Acceleration and in Uniform Motion in Water
A. LAIRD, Prof. of Mech. Eng., Univ. of Calif., Berkeley.

10:15 **Mean Effective Wave Energy Direction with Application to Coastal Problem Analysis**

OMAR LILLEVANG, Senior Engr., Leeds, Hill & Jewett, Consulting Engrs., Los Angeles.

Sanitary Engineering Division

8:45 a.m. Los Angeles Room

8:45 **Introduction**

HERMAN P. AMBERG

9:00 **Development of Hydrographs for Estimating Peak Sewage Flows**

PETER S. EAGLESON, Asst. Prof. of Hydraulic Eng., M. I. T., Cambridge, Mass.

9:30 **Research in the Equipment and Treatment Field**

J. D. WALKER, President, Walker Process Equip. Inc., Aurora, Ill.

10:00 **Summary of Current Research in Water Pollution and Sewage Treatment**

HARRY A. FABER, Research Coordinator, Public Health Service, to be presented by JACK E. MCKEE, Prof., Calif. Inst. of Tech.

10:30 **What Is Needed in Sewage Disposal Research**

RICHARD H. BOGAN, Prof., Univ. of Washington, Seattle.

Conditions of Practice Dept., Engineers in Public Practice Committee

11:00 a.m. Garden Room E

Engineers in Public Practice, at State and Local Levels

The Formation, Directive, Objectives, and Program of the Committee

M. J. SHELTON, Chairman, Committee on Engrs. in Public Practice.

Problems of Civil Engineers in State Civil Service

ROBERT D. GRAY, Calif. Inst. of Tech., Member, Calif. State Personnel Board.

Civil Service Problems of Engineers in County and Municipal Government

JEAN VINCENZ, Director of Public Works, County of San Diego.

Ethics for Engineers in Public Practice

R. ROBINSON ROWE, Calif. Div. of Highways.

PUBLIC PRACTICE LUNCHEON

Thursday, Feb. 12

12:30 Pacific Ballroom

Speaker: DEAN L. M. BOELTER, College of Engineering, Univ. of Calif., Los Angeles.

Subject: The Engineer in Future City Planning

Presiding: FRANCIS S. FRIEL, President ASCE.

Chairman: EVERETT B. MANSUR, Vice Chairman, City Planning Division.

All members, guests and friends of the Society are invited to attend, sharing a topic of professional interest.

Tickets for this event must be purchased before 10:00 a.m. on Thursday.

THURSDAY AFTERNOON

FEB. 12

City Planning Division

2:30 p.m. Sierra Room

Urban Renewal Panel

RICHARD L. STEINER, Urban Renewal Commissioner, Housing and Home Finance Agency, Washington, D. C.

IRA J. BACH, Commissioner of Planning, Chicago, Ill.

HARRY N. OSGOOD, Director of Urban Programs, Sears, Roebuck and Co., Chicago, Ill.

WILLIAM H. CLAIRE, Asst. Executive Director, The Community Redevelopment Agency, Los Angeles.

Construction Division

2:30 p.m. Garden Room E

2:30 **Prestressed Concrete Construction in Russia**

BEN C. GERWICK, JR., President, Ben C. Gerwick, Inc. The paper will be illustrated by 16-mm movie and 35-mm slides taken by Mr. Gerwick while on a recent trip to Russia with a group of engineers.

3:00 **The Summerland Offshore Drilling Platform**

J. E. RINNE, Engr., Standard Oil Co. of Calif., San Francisco. Moving pictures and slides will be used to illustrate the paper.

3:30 **Legal Problems Arising under Construction Contracts**

SAMUEL S. GILL, Attorney, firm of Thelen, Marrin, Johnson and Bridges.

4:00 **Large-Scale Excavation with Nuclear Explosives**

GERALD W. JOHNSON, Test Division Leader, Univ. of Calif., Radiation Laboratory. Address to be given by CLIFFORD M. BACIGALUPI.

Power Division

2:30 p.m. Mission Room

2:30 **Bureau of Reclamation Practice for Control of Cracking in Arch Dams**

CHARLES L. TOWNSEND, Supervising Engr., U. S. Bur. of Reclamation, Denver, Colo.

3:45 **Corps of Engineers Practice and Experience in Controlling Cracking in Masonry Dams**

WILLIAM R. WAUGH, Chief, and J. A. RHODES, Civil Engr., Concrete Branch, Eng. Div., Civil Works, Office of the Chief of Engineers, Corps of Engineers, Washington, D. C.

4:45 **Summary Discussion on Control of Cracking in Masonry Dams**

K. B. KEENER, Chairman, Committee on Control of Cracking in Masonry Dams; Chief Design Engr., Bureau of Reclamation, Denver, Colo.

Soil Mechanics and Foundations and Structural Divs.

2:30 p.m. Garden Room W

2:30 **Dynamic Effects of Earthquakes**

RAY W. CLOUGH, Univ. of Calif., Berkeley.

3:30 **Earthquake-Resistant Design Techniques**

JOHN A. BLUME, Consulting Structural Engr., San Francisco.

Sanitary Eng. Division

2:30 p.m. Los Angeles Room

2:30 **The Role of Waste-Water Reclamation in Meeting Southern California's Water Requirements**

MAX BOOKMAN, District Engr., State Water Resources, Calif. State Bldg., Los Angeles.

3:10 **Waste-Water Reclamation in Los Angeles County**

R. F. BOWERMAN, Div. Engr., County Sanitation Districts of Los Angeles County.

3:50 **Waste-Water Reclamation in San Diego County**

RALPH STONE, Ralph Stone and Co., Beverly Hills.

4:30 **Waste-Water Reclamation for Golf Course Irrigation**

ROBERT C. MERZ, Prof. of Civil Eng., Univ. of Southern Calif., Los Angeles.

THURSDAY EVENING ENTERTAINMENT

Dinner-Dance 8:00 p.m.

Pacific Ballroom Statler-Hilton Hotel

CITY PLANNING ANNIVERSARY DINNER

Sponsored jointly by ASCE City Planning Division and Southern California Planning Congress.

Thursday, Feb. 12

6:00 p.m. Reception, Garden Room

7:00 p.m. Thirty-Fifth Anniversary Dinner, Garden Room

Speaker: HAROLD M. LEWIS, Consulting Engr. and City Planner and former Chief Engr. of Regional Plan Association, New York, N. Y.

Subject: The Engineer's Contribution to City and Regional Planning.

Guests of Honor: Engineers prominent in city and regional planning, including engineers who have served as chairmen or members of the City Planning Division Executive Committee, ASCE, or who have served as president of the Southern California Planning Congress.

Tickets for this event must be purchased by 10:00 a.m., Thursday, Feb. 12.

FRIDAY MORNING

FEB. 13

Construction and Sanitary Engineering Divisions

8:45 a.m. Los Angeles Room

8:45 **Introductory Talk on Objectives and Accomplishments of Hyperion Outfall Sewer**

CUSHING PHILLIPS, President, Los Angeles Board of Public Works.

9:00 **Design of the Hyperion Ocean Outfalls**

DAVID R. MILLER, Project Engr., Hyperion Engineers, Los Angeles.

9:30 **World's Deepest Submarine Pipeline**

JARVIS GATES, Healy Tibbitts Construction Co., San Francisco, Calif. Film showing construction of 22-in. steel sludge line.

10:00 **Construction of Concrete Outfall Line of 12-Ft. Diameter**

ARTHUR FERTELL, Project Manager, Hyperion Constructors. Film will illustrate talk.

11:00 **Directions and Information Regarding Transportation for Long Beach and Hyperion Plant Field Trip**

RICHARD C. GERKE, Contracting Engr., Bethlehem Pacific Coast Steel Corp., Los Angeles.

Irrigation and Drainage Division

8:45 a.m. Assembly Room

8:45 **Present Irrigation and Drainage Methods in Russia**

WILLIAM W. DONNAN, U.S. Dept. of Agriculture, Agriculture Research Service.

9:35 **Discussion**

9:45 **Drainage Methods, Coachella Valley, California**

LOWELL WEEKS, Chief Engr., Coachella Valley Water District.

10:15 **Discussion**

10:25 **Problems Concerned with Consolidation and Betterment of Irrigation Enterprises**

A. ALVIN BISHOP, Irrigation Engineer, Utah State Univ., Logan.

Power Division

8:45 a.m. Mission Room

8:45 **Civil Engineering Aspects of the Santa Susana Experimental Nuclear Power Station**

DALLAS I. DOWNS, Civil Engr., Southern Calif. Edison Co., Los Angeles; ROBERT F. BOGGUS, Design Engr., and GEORGE E. DEEGAN, Supervisor of Development, Sodium Reactor Experiment, North Amer. Aviation, Inc., Canoga Park, Calif.

9:45 **Vallecitos and Humboldt Bay Atomic Power Plants**

F. F. MAUTZ, Supervising Engr., and GORDON L. COLTRIN, Supervising Civil Engr., Pacific Gas and Electric Co., San Francisco.

Soil Mech. and Foundations and Structural Divisions

8:45 a.m. Sierra Room

8:45 **Seismic Design in Japan**

C. MARTIN DUKE, Asst. Dean of Eng., Univ. of Calif., Los Angeles.

9:30 **Theoretical Soil Dynamics**

H. B. SEED, Asst. Prof., Eng. Materials Lab., Univ. of Calif., Berkeley.

STUDENT AWARDS LUNCHEON

Friday, Feb. 13

12:30 p.m. Golden State Room

Speaker: GOVERNOR GEORGE D. CLYDE, Utah.

Subject: Government, the Engineer, and the Future.

Presiding: FRANCIS S. FRIEL, President ASCE.

Chairman: WALTER H. CATES, Past President, Los Angeles, Section, ASCE.

All members, guests and friends of the Society are invited to attend this luncheon, which will be of wide professional interest.

Tickets for this event must be purchased before 10:00 a.m. on Friday.

FRIDAY AFTERNOON

FEB. 13

Irrigation and Drainage Division

2:30 p.m. Assembly Room

2:30 **Methods of Evaluating Irrigation Systems**

DELL SHOCKLEY, Head, Irrigation Section, Soil Conservation Service, Portland, Oreg.

3:20 **Drainage Problems, San Joaquin Valley**

WILLIAM T. BERRY, Chief of Resources Planning, Div. of Water Resources, State of Calif.

4:00 **Recent Observations on Foreign Research Methods of Increasing Water Supplies**

MARTIN R. HUBERTY, Prof. of Irrigation and Eng., U.C.L.A., and Dir., Water Resources Center.

Soil Mechanics and Foundations Division

2:30 p.m. Garden Room W

2:30 **Ground Shock from Atomic Blasts**

JOHN PETERS, U. S. Air Force.

3:15 **Experimental Soil Dynamics**

JOHN BISHOP, Head, Soils Lab., U. S. Navy, Port Hueneme, Calif.

FIELD TRIP TO HYPERION OUTFALL SEWER

Friday, Feb. 13

11:30 a.m. Busses leave Statler Hotel. Busses proceed to the Long Beach casting yard of the United Concrete Pipe Corporation, via Santa Ana and Long Beach Freeways, where lunch will be served. After lunch, there will be a tour of the casting yard to see the manufacture and handling of the 12-ft concrete pipe; then to the Hyperion Constructors' yard, adjacent to the casting yard, to see the pipe sections joined together to be floated to the site of the pipeline at Hyperion and then lowered into permanent position.

1:30 p.m. Leave Long Beach for Hyperion Constructors' plant at El Segundo

4:15 p.m. Busses leave for return trip to Statler Hotel

Because of safety regulations, this trip is for men only.

Tickets for this tour must be purchased before 5:00 p.m., Thurs., Feb. 12.

STUDENT CHAPTER FACULTY ADVISERS CONFERENCE

Saturday, Feb. 14

8:45 a.m. Mission Room

All student Chapter Faculty Advisers and Contact Members in attendance at the Los Angeles Convention are invited to take part in this round-table discussion of student affairs.

STUDENT ACTIVITIES

All Student Chapters of ASCE in the Western Region have been invited to attend the Convention. The student paper contest will be conducted in two parts. The Student Chapters in the Pacific Southwest Conference will compete with each other and the guest participants from the remainder of the western region will compete with each other. Included in this guest group are students from the University of Mexico, Mexico City, and the Monterey Inst. of Technology in Monterey, Mexico.

The winners of the student paper contest will be announced at the noon luncheon by George D. Clyde, Governor of Utah.

The afternoon session of the Student Chapters will be held at the Calif. Inst. of Technology. There will be an address by a representative of the national officers of ASCE and a tour of the campus, including the civil engineering facilities and the science research laboratories.

Following the afternoon session the students will enjoy a banquet at the Engineers' Club in the Biltmore Hotel, where they will be entertained by Mr. Jack Kennedy, who will give his famous discourse on "Well Drilling in the Southwest."

Following the banquet the students will spend an enjoyable evening at the student smoker.

Saturday the students will visit the Naval Ordnance Test Station at Morris Dam to see the torpedo range facilities located there. They will lunch in Azusa and return to Los Angeles.

STUDENT CONTESTS

Pacific Southwest Council

8:45 a.m. Golden State Room

The following Student Chapters will participate: Arizona, Hawaii, Utah, Southern Calif., Nevada, California (Berkeley), Utah State, Calif. Inst. of Tech., San Diego State, Stanford, Santa Clara.

8:45 a.m. Garden Room W

The following chapters will participate: Alaska, New Mexico, New Mexico A.&M., South Dakota School of Mines, Washington, Mexico, Monterey Inst. of Tech., Idaho, Oregon, Montana, Wyoming, Colorado, Denver, Colorado State.

FIELD TRIP TO CALTECH

2:30 **Buses leave the hotel for Caltech campus**

A business session and a tour of facilities will be presented.

STUDENT FIELD TRIP TO MORRIS DAM

Saturday, Feb. 14

At 8:45 buses will leave the hotel for a tour of Morris Dam.

LOCAL SECTIONS CONFERENCE

Mission Room Hotel Statler

9:45 a.m. Monday, and Tuesday, Feb. 9 and 10.

Representatives of Local Sections of ASCE from a selected area around the Convention city will convene for a discussion on expanding activities of the Society at the local level. This conference, which is primarily for invited delegates of the selected Local Sections, will be open to all who may be interested in the activities and operational details of ASCE Local Sections.

BOARD MEETINGS

Mission Room

The ASCE Board of Direction will meet on Monday and Tuesday, Feb. 9 and 10.

WOMEN'S PROGRAM

A series of most interesting activities have been planned for the entertainment of the women attending. Details will be included in a later program.

INFORMATION AND REGISTRATION

Information and registration facilities will be maintained in the lobby of the Statler-Hilton Hotel throughout the days of the Convention. Mail and messages will be held for members at the information desk.

CONVENTION OFFICE AND PRESS ROOM

Foy Room and St. Louis Room

For the convenience of the members and the effective operation of the Convention, a Convention office and a press room will be in business throughout the Convention.

SOCIETY NEWS

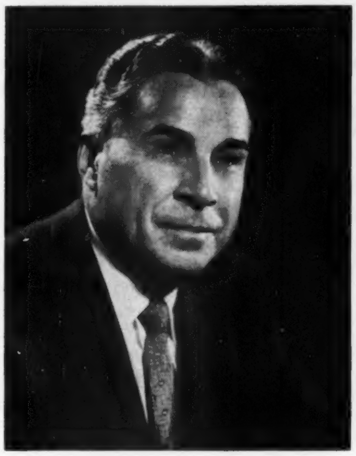
Hal W. Hunt Becomes Editor of "Civil Engineering"

With this issue Hal W. Hunt becomes editor of Civil Engineering, succeeding Walter E. Jessup who retired last month. Mr. Hunt brings to the position a wide background of experience and an established reputation in both the construction and editorial fields. He has been active on projects in nineteen states and in Europe. The work has been in both field and office with private engineering firms, with public agencies, and with contractors. Mr. Hunt holds professional engineer and land surveying licenses. Since March 1957 he has been executive editor of Civil Engineering.

For eight years in the 1940's Mr. Hunt was associate editor of *Engineering News-Record,* writing in the construction, business, and labor relations fields. Immediately prior to coming to the Society, he served for two and a half years in Spain, first as project engineer on design of the $70,000,000 naval port and airport development on Cadiz Bay for the Architect-Engineer Spanish Bases, and then as chief engineer for Corbetta-Coviles on the construction of the $20,000,000 harbor at Rota.

A civil engineering graduate of the University of Iowa, Mr. Hunt began his professional career with the Iowa Highway Commission. In the 1930's he was project engineer for the Construction Plant Division of the Tennessee Valley Authority. He worked on lock, dam and bridge construction for contractors and supervised design of plants for major construction projects. As executive engineer of the Western Foundation Corporation, he served as superintendent in the field for a variety of jobs and handled publicity and public relations.

While in Portland, Ore., from 1951 to 1953 as resident engineer for Frederic R. Harris, Inc., of New York, on construction of a pier at Swan Island for the Port of Portland Commission, he started and edited the Oregon Section's news sheet, "The Oregon Civil Engineer." Long active in the Society's Construction Division, he has served it as program committee chairman and secretary. Mr. Hunt is a member of The Moles, a New York society of heavy construction men, and is an Iowa chapter honorary member of Chi Epsilon.



HAL W. HUNT

EJC Survey Shows Rise in Engineers' Salaries

The new Engineers Joint Council survey of engineers' salaries, out this January, is the most comprehensive analysis of engineers' earnings ever made in the United States. The study shows that salaries of engineers in industry, government, and education are continuing the upward trend observed in EJC's previous survey interval, 1953-56. The overall median in 1958 was $8,750—up 13 percent from 1956, or 6.5 percent annually. The overall median in 1953 was $6,500, and in 1956 it was $7,750. The increase between 1956 and 1958 was not as great as that between 1953 and 1956. Government salaries went up proportionately more than industrial salaries in the past two-year period as a result of readjustment in highway salaries and a flat increase in Civil Service salaries.

Covering over 190,000 engineers, the 1958 survey represents a sampling of about three-fifths of all engineers employed in industry and about one-fourth of those in government employ. The greatly increased scope of the new survey was permitted by the increased cooperation of industry, which was convinced by the 1956 survey that it would not be harmful—and might, in fact, be beneficial—to participate.

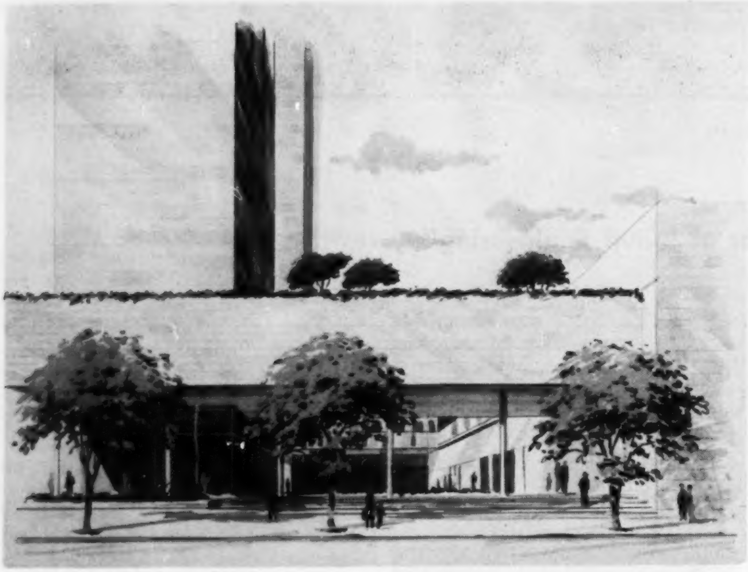
Following the pattern of its two previous reports, the current publication presents the annual earnings of engineers in relation to their year of entry into the profession. It covers a 1958 payroll of $2 billion and an earning range of from $5,000 to $20,000.

While the survey does not attempt a break-down of engineers' salaries by branches of the profession, it does show that the highest-paying industry is probably the chemical, followed by the petroleum and aircraft industries. Utilities, railroads, machinery manufacturing, and communications pay less well. The median starting salary of $494 per month for the whole group studied would seem to refute the contention that there is no shortage of engineers. In industry the median starting salary for Ph.Ds is $9,925 a year, and for Ph.Ds with experience it is $11,700. The median age of the whole engineering population studied was rather young, around 35. Employees of the federal government were considerably older than those in industry.

Copies May Be Ordered

The survey, which is entitled "Trends in the Earnings of Engineers, 1956-1958," is available from EJC, 29 West 39th Street, New York 18, N. Y. The price is $3.00 a copy, with discounts available on quantity orders on request.

Member Gifts Campaign for UEC Reaches Half-Way Point



Main entrance to the new United Engineering Center will be on United Nations Plaza in one of the city's most cosmopolitan and interesting developments. Next-door neighbor on the Plaza will be the recently announced United States Embassy Building for the United Nations (see page 91), the only U. S. Embassy office building in the continental United States.

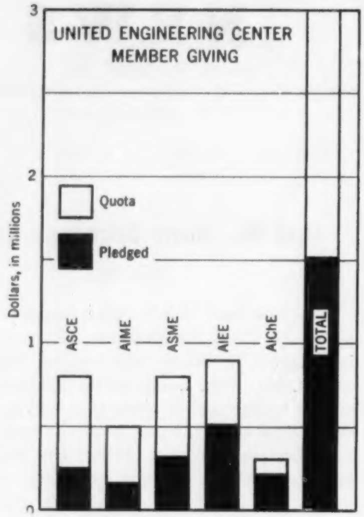
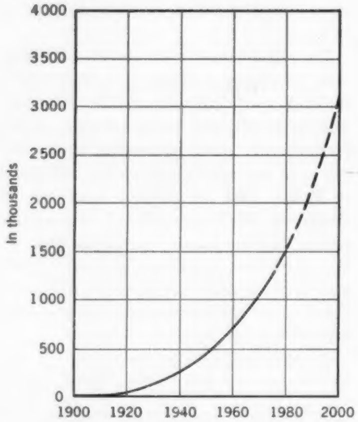


FIG. 1. Member-giving for UEC as of December 12.



The projected increase in engineering population, indicated in this curve, makes essential the building of a new center to serve as a focal point for the profession.

The news about the Member Gifts Campaign for the United Engineering Center is good, but still not good enough. That is the opinion of the Member Gifts Committee. At a recent meeting the committee decided to extend indefinitely the closing date of the campaign, originally set for November 30. The campaign will continue until all quotas are met; all the societies have been urged to see that every member is solicited personally for his contribution by early 1959.

Though many have yet to give before the $3,000,000 member quota is filled, the tempo of the drive is speeding up. The four weeks ending November 21 showed $353,000 in subscriptions, by far the largest four-week showing in the campaign. The flow of subscriptions for a single week was at a new peak of $129,000 for the week ending November 28.

More gratifying still is the fact that, as of December 12, member giving has passed the half-way mark, with a total of $1,519,209. A month ago the campaign had just passed the million-dollar mark, only one-third of the way to the goal. The industry campaign, with $3,817,583 collected or pledged, is pressing on toward its goal of $5,000,000. As indicated in Table I, on December 12 the grand total—member and industry gifts together—stands at $5,336,792, or 66 percent of the $8,000,000 total set for the two groups. The middle of December all accounts are being turned over to IBM to handle an expected 92,000 contributions.

The average contribution of ASCE members at $77 is considerably above the $57 average for all the contributing societies. Since the campaign started, however, ASCE has been trailing the other Founder Societies in percentage of quota pledged. Encouraging, too, is the fact that the sum of $254,561 has been pledged by only 3,296 members. With 39,000 members still to be heard from (and the committee is hoping to hear soon!), the outlook for meeting our quota should be bright.

The Honor Roll

It is especially good news that five ASCE Sections have gone over the top with their quotas, and others are reported to be on the verge. The enterprising five —in the order in which they met their assigned goals—are the Kentucky Section, the Lehigh Valley Section (at 115 percent), the Nashville Section, the Cincinnati Section, and the Columbia Section.

The Member Gifts Committee has been saddened by the death of Charles F. Kettering, Honorary Member of ASCE and honorary chairman of the Member Gifts Campaign. In a recent message to the profession, Dr. Kettering remarked that, with the significance of engineering being recognized as never

Table I. Quotas and Pledges to UEC as of December 12

Society	Goals in Dollars	No. of Subscribers	Amount Pledged	% of Goal	$ per Subscriber
ASCE	800,000	3,296	254,561	32	77
AIME	500,000	1,554	168,186	34	104
ASME	800,000	6,105	326,612	41	54
AIEE	900,000	12,763	519,198	57	40
AIChE	300,000	4,738	223,862	74	47
Others	....	197	26,788	..	136
Total	*3,000,000	28,653	1,519,207	51	53
Industry	5,000,000	270	3,817,583	76	14,100
Grand Total	8,000,000	28,923	5,336,792	66	

* While the overall goal of member giving is shown as $3,000,000, the quotas accepted by the Societies total $3,300,000

ASCE Giving Passes $255,507, as of December 12

Local Section	Quota	Amount Pledged	% Quota
ZONE I	$197,300	$ 77,969	40
District 1	**133,300**	**58,342**	**44**
Brazil	2,100		
Metropolitan	119,200	56,657	48
Panama	1,300	90	7
Puerto Rico	3,100	1,595	52
Rep. Colombia	2,400		
Venezuelan	5,200		
District 2	**43,400**	**7,849**	**18**
Connecticut	11,000	263	2
Maine	4,700	200	4
Massachusetts	23,000	5,113	22
New Hampshire	1,800	413	23
Rhode Island	2,900	1,860	64
District 3	**20,600**	**9,278**	**45**
Buffalo	4,400	1,795	41
Ithaca	2,400	1,195	50
Mohawk-Hudson	7,500	2,748	37
Rochester	1,900	1,189	63
Syracuse	4,400	2,351	54
ZONE II	169,700	63,326	38
District 4	**34,000**	**30,397**	**89**
Delaware	4,100	2,255	55
Lehigh Valley	4,200	4,827	115
Philadelphia	20,000	19,386	97
Central Pa.	5,700	3,929	69
District 5	**27,000**	**4,092**	**15**
Nat'l Capital	27,000	4,092	15
District 6	**49,000**	**11,902**	**25**
Maryland	15,000	4,026	27
Pittsburgh	17,000	3,909	23
Virginia	13,300	3,931	30
West Virginia	3,700	36	1
District 10	**59,700**	**14,435**	**25**
Alabama	8,900	1,775	20
Florida	11,500	470	4
Georgia	11,000	4,941	45
Miami	5,200	270	5
Nashville	2,700	2,730	101
N. Carolina	6,300	1,418	23
S. Carolina	4,900	1,102	23
Tenn. Valley	9,200	1,729	19
ZONE III	202,200	54,164	27
District 7	**39,900**	**3,792**	**10**
Duluth	1,500		
Michigan	18,000	393	2
Northwestern	8,000	960	12
Wisconsin	10,700	2,439	23
S. Dakota	1,700		
District 8	**37,100**	**12,218**	**33**
Cent. Ill.	6,500	2,170	34
Illinois	29,000	10,048	35
Tri-City	1,600		
District 9	**45,700**	**17,084**	**37**
Akron	3,100		
Central Ohio	5,100	65	1
Cincinnati	4,700	4,993	106
Cleveland	9,300	950	10
Dayton	3,300	85	3
Indiana	11,000	4,551	42
Kentucky	6,100	6,190	101
Toledo	3,100	250	8
District 14	**31,500**	**10,120**	**32**
Mid-Missouri	3,500	550	16
Mid-South	11,000	3,205	29
Oklahoma	6,900	1,870	27
St. Louis	10,100	4,495	49
District 16	**48,000**	**8,450**	**18**
Colorado	13,900	1,888	14
Iowa	5,900	1,503	26
Kansas City	12,000	3,179	27
Kansas	7,000	1,850	24
Nebraska	6,300	30	1
Wyoming	2,300		
ZONE IV	230,800	60,048	26
District 11	**132,600**	**36,509**	**28**
Arizona	5,000	1,120	23
Hawaii	6,300	4,233	67
Intermountain	4,700	5	1
Los Angeles	50,200	9,587	19
Sacramento	16,300	138	1
San Diego	6,000	1,801	30
San Francisco	44,100	19,625	45
District 12	**40,400**	**9,732**	**24**
Alaska	2,200	270	12
Columbia*	2,200	900	45
Montana	3,300		
Oregon	10,900	1,200	11
Seattle	12,200	3,015	25
S. Idaho	2,300	706	32
Spokane	3,100	963	31
Tacoma	4,200	2,588	62
District 15	**57,800**	**11,307**	**20**
Louisiana	13,000	1,260	10
Mexico	1,400		
New Mexico	4,000	190	5
Texas	39,400	9,857	25
	†$800,000	$255,507	32

* Quota exceeded Dec. 15, 1958

† The $800,000 Society quota is apportioned according to assigned Local Section membership

before, the engineer needs "an adequate platform . . . a symbol of his dynamic purpose." Mr. Kettering saw the United Engineering Center as providing that platform and that symbol.

"Every engineer," he said, "has a responsibility to participate in attaining this great objective by making a personal contribution to the United Engineering Center Fund Campaign. The program is sound. It is timely. It merits your support. To you—my fellow engineers—I extend my strong personal endorsement of the project. I urge you to give, not only in dollars but in service to the campaign."

New Freeman Fellowship Open

Freeman Fellowship applications are now open for the academic year 1959-1960, and can be submitted any time before March 1, 1959, when the competition will close officially. The fellowship is open to younger members of both ASCE and ASME, who wish to undertake a worthy program in the fields described in the 1958 Official Register (page 144). Reprints of the rules of award are available on request.

Each applicant must submit a detailed prospectus of his program, covering at least nine months, and must furnish evidence of his qualification to carry out the proposed program. Applications should also include a statement of funds needed from the Fellowship, to a maximum of $3,000. Address all communications to the Executive Secretary, American Society of Civil Engineers, 33 West 39th Street, New York 18, N. Y.

Suggested uses for the income from the fund include:

1. Grants toward expenses for experiments, observations, and compilations toward discovering valuable new engineering data.
2. Underwriting fully or in part some of the loss sustained in publishing meritorious books, papers, or translations pertaining to hydraulic science and art.
3. A prize for the most useful paper relating to the science or art of hydraulics.
4. A traveling scholarship, open to members under 45 in any grade of membership, in recognition of achievement or promise, for the purpose of aiding candidates to visit engineering works in the United States and abroad.
5. Grants for assisting in the translation, or publication in English, of papers or books on hydraulics in foreign languages.

ASCE Membership as of December 9, 1958

Members	10,236
Associate Members	14,417
Junior Members	17,756
Affiliates	76
Honorary Members	44
Total	42,529
(Dec. 9, 1957	40,930)

ASCE Los Angeles Convention, February 9-13

Extensive freeway system that handles Los Angeles County's 2,500,000 vehicles without too much congestion is shown here. These multi-lane thoroughfares, sometimes with two-deck overpasses at the interchanges, have enabled Los Angeles to keep expanding, while permitting California's traditional gracious living away from business.

Committees for the Los Angeles Convention

Trent R. Dames, *General Chairman*

Assistant General Chairmen:
Communications
Sterling S. Green
Operations
Nathan D. Whitman, Jr.
Personnel
Louis J. Alexander
Plans
Mark E. Salsbury

Attendance Promotion Committee

Fred R. Cline, *Chairman*
John W. Gerhart, *Vice Chairman*

Entertainment Committee

Irvan F. Mendenhall, *Chairman*
Marvin J. Kudroff, *Vice Chairman*

Finance Committee

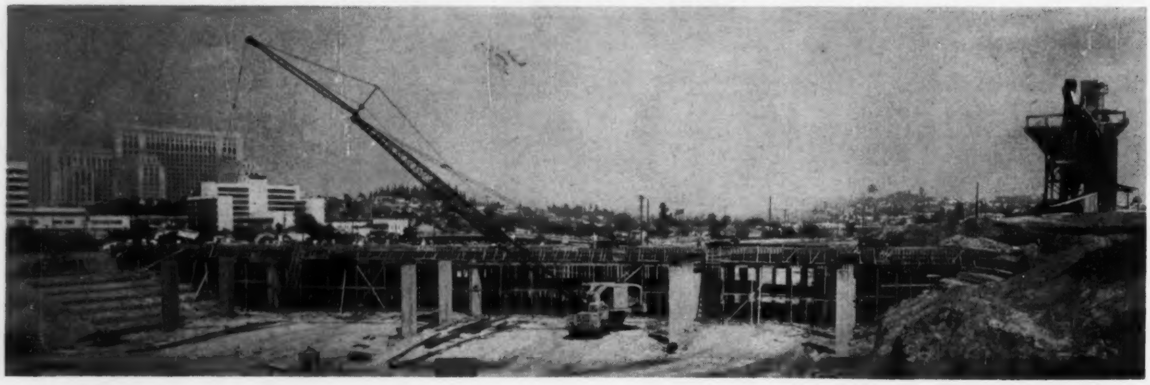
David L. Narver, Jr., *Chairman*
Alfred E. Waters, *Vice Chairman*

Excursions Committee

Leonard L. Longacre, *Chairman*
Byron E. Jones, *Vice Chairman*

One of many debris basins operated by Los Angeles County Flood Control District. These basins trap debris from the steep San Gabriel Mountains, protecting foothill communities on northern edge of the metropolitan area.

Structure under construction on the Golden State Freeway, which skirts north edge of business district. Many contracts underway will be visited on the Highway Division's all-day field trip.



General Luncheon Session Committee
L. Leroy Crandall, *Chairman*
Byron P. Weints, *Vice Chairman*

Hotel Arrangements Committee
Lewis K. Osborn, *Chairman*
Philip Abrams, *Vice Chairman*

Ladies Activities Committee
Mrs. Irvan F. Mendenhall, *Chairman*
Mrs. Marvin J. Kudroff, *Vice Chairman*

Professional Program Committee
Jack E. McKee, *Chairman*
William H. Claire, *Vice Chairman*

Public Relations and Publicity Committee
Burton S. Grant, *Chairman*
Frank E. Alderman, *Vice Chairman*

Reception Committee
Walter T. Norris, *Chairman*
Hugh E. Mulholland, *Vice Chairman*

Registration and Information Committee
Norman B. Hume, *Chairman*
Jack M. Betz, *Vice Chairman*

Student Activities Committee
Charles M. Corbit, *Chairman*
Alfred C. Ingersoll, *Vice Chairman*

Technical Program Committee
George E. Brandow, *Chairman*
Harold Olmstead, *Vice Chairman*

Transportation Committee
John B. Howe, *Chairman*
Samuel H. Keller, *Vice Chairman*

Aerial view shows extensive Rio Hondo Spreading Grounds operated by Los Angeles County Flood Control District. This area will be visited on the all-day field trip scheduled by the Hydraulics Division.

View of downtown Los Angeles showing Convention headquarters (the Statler) in right foreground. This is the hub of the extensive freeway system in the metropolitan area. The Harbor Freeway enters the four-level interchange in the background.

Panama Canal Receives "Seven Wonders" Plaque

ASCE Vice-President Waldo Bowman unveils plaque honoring the Panama Canal as one of the "Seven Civil Engineering Wonders of the United States." The honor was given official recognition at a ceremony on November 15, a highlight of the Theodore Roosevelt Centennial Week. The plaque, citing the Canal as "a cut linking two oceans," was unveiled at its permanent location in the rotunda of the Administration Building at Balboa Heights. In 1955 the Society, in its search for projects that could qualify as a "wonder," found that the Canal was an almost unanimous choice of those making nominations. The Canal was the last of the "Wonders" to receive its plaque.

ASCE Establishes $5,000 Research Fellowship

Aware of the need for more basic research, the ASCE Board of Direction has established a new Fellowship Grant in the field of civil engineering research. The grant, which will aid in the creation of new knowledge "for the benefit and advancement of the science and profession of civil engineering," is made from current Society income. Rules to guide applicants are being published in the 1959 ASCE Official Register, as follows:

1. The grant, in the amount of $5,000, is made annually.

2. Applicants must be members of the Society in any grade, citizens of the United States, and graduates from an accredited curriculum.

3. The award will be made by the Committee on Fellowships, Scholarships, Grants and Bequests on the basis of the following:
   - (a) Transcripts of scholastic records.
   - (b) Ability to conceive and explore original ideas (letters of recommendation will be considered only when they contribute specific information on this ability).
   - (c) Description of proposed research and its objectives, including a statement from the institution at which the research is to be done that the applicant and proposed research are acceptable to the institution. Preference is given to research that is basic in nature and concept, rather than applied, developmental, or designed to extend or elaborate information. Research requiring an extensive testing program will not be considered.

4. Applications in specified forms will be received by March 15, 1959, and awards made by May 15, 1959, for a twelve-month period beginning not later than the following October 1.

5. The Research Fellow is required to devote full time to his proposed research during the tenure of the fellowship.

6. The Research Fellow is required to submit a report on his research, suitable for publication, to the Secretary of the Society on completion of the tenure of his fellowship.

Six copies of application for the fellowship should be submitted. All correspondence should be addressed to William H. Wisely, Executive Secretary of ASCE, 33 West 39th Street, New York 18, N. Y.

Engineering Salary Index

Several requests have been received for an explanation of the semiannual Engineering Salary Index, which appears monthly in Civil Engineering. The Index is predicated upon the grades paid by a selected group of correspondents to engineers in the first three ASCE grades. The grades are the equivalent of Federal grades GS5, GS7, and GS9. The Index is arrived at by taking the sum of the 1956 GS5, GS7, and GS9 annual salaries as the denominator and the sum of ASCE Grades 1, 2, and 3 for the period covered by the Index as the numerator and arriving at a figure. The approximate percent changes shown have been on a quarterly basis in the past; in the future they will be shown for every six months.

The index is intended as an indicator of trends rather than a precise measurement of changes in salaries. From it can be determined whether salary changes are drastic, moderate, or non-existent. Increases currently shown reflect the situation in states and areas, which were behind the rest of the country and are not general among the top-salaried positions.

The six regions referred to in the highway department section of the index are: Region I, New England; Region II, the Middle Atlantic States; Region III, the remainder of the northeast quadrant of the United States; Region IV, the Southeast; Region V, the Plains States; and VI, the Rocky Mountain and Pacific Coast region.

ASCE ENGINEERING SALARY INDEX

Consulting Firms

City	Current	Last Quarter
Atlanta	1.11	1.11
Baltimore	1.11	1.11
Boston	1.15	1.13
Chicago	1.30	1.26
Denver	1.22	1.19
Houston	1.12	1.08
Kansas City	1.14	1.14
Los Angeles	1.16	1.16
New York	1.20	1.17
Pittsburgh	1.05	0.93
Portland (Ore.)	1.15	1.15
San Francisco	1.19	1.17
Seattle	1.06	1.07

Highway Departments

Region	Current	Last Quarter
I, New England	0.91	0.85
II, Mid. Atlantic	1.17	1.17
III, Mid. West	1.25	1.15
IV, South	1.09	1.07
V, West	1.00	0.97
VI, Far West	1.15	1.15

Figures are based on salaries in effect as of May 15, 1958. Base figure, the sum of Federal Civil Service, G. S. Grades 5, 7, and 9 for 1956, is $15,930.

State Attorneys Support Society's Bidding Stand

Recent interpretations given by the attorneys general of two Southern States—South Carolina and Mississippi—constitute a victory for ASCE in the stand it has taken against the practice employed by certain state highway departments and municipalities in inviting or taking bids for professional engineering services.

Of special interest to ASCE is the ruling of T. C. Callison, attorney general of South Carolina, regarding South Carolina State Highway Department work. For the past five years the Society has been fighting an interpretation of South Carolina state law, which held that it was mandatory to advertise and accept bids for engineering work. At the suggestion of ASCE, Clinch H. Belser, Columbia, S. C., attorney and member of the South Carolina Assembly, recently wrote Mr. Callison, asking whether the State Highway Department is required by law to advertise and accept bids for engineering work.

On November 26 Mr. Callison replied: "It is my opinion that under the amended [1956] Section, it is not mandatory for the Department to advertise for professional services of bridge or other engineers on any bridge or highway project; however, it is my opinion that the amended Act does not prohibit the Department from advertising for such professional services. It is my opinion, therefore, that the question of advertising for engineering services is a matter in the sound discretion of the Chief Highway Commissioner or the Highway Department."

Mississippi Ruling

In similar vein is an opinion expressed by Joe T. Patterson, attorney general of Mississippi, in response to a letter from O. B. Curtis, secretary of the Mississippi State Board of Registration for Professional Engineers, requesting clarification of the matter. Mr. Patterson wrote: "I am of the opinion that a contract for professional engineering services is just like that for any other professional services, such as an attorney, and that a public agency is not required by law to advertise for bids for such professional engineering services."

Although only the South Carolina interpretation arose out of direct ASCE action, both opinions are of high significance in the Society's continuing effort to eliminate the practice of advertising and accepting bids for professional engineering services.

SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

DANIEL W. MEAD PRIZES:	*1959 contest closes May, 1, 1959. See 1958 Official Register, page 134; September 1958 issue of CIVIL ENGINEERING, page 78.*
FREEMAN FELLOWSHIP:	*1959-1960 award closes May 1, 1959. See Official Register, page 144; this issue, page 77.*
ERNEST E. HOWARD AWARD:	*1959 award closes May 1, 1959. See Official Register, page 133; September 1958 issue of CIVIL ENGINEERING, page 80.*
ASCE RESEARCH FELLOWSHIP:	*1959 award closes March 15, 1959. See January 1959 issue of CIVIL ENGINEERING, page 80.*

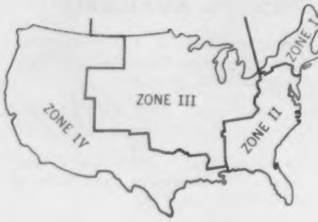
Cleveland Section Plans for May 1959 Convention

Plans are rapidly taking shape in Cleveland for the Society's Summer Convention, to be held at the Cleveland Hotel, May 3-7, 1959, with the Cleveland Section as host. The Section's Convention Committee has already met a number of times to formulate plans for an outstanding program and memorable entertainment, under the able leadership of Michael Phillips, president of the Section, and Convention Chairman W. R. Swatosh.

The committee calls attention to the fact that Cleveland is in the heart of one of the greatest concentrations of diversified industry in the world. This fact alone assures many topics of special interest to civil engineers and gives promise of a wide and diversified technical program. On the cultural front, Cleveland is the seat of several great universities and of an Art Institute second to none. Impressive in its lakefront location, Cleveland is also a metropolitan center where every shopping taste may be pleasantly indulged.

There will be more about the Convention in the February issue, and the detailed program of technical and social events in March. In the meantime, the Convention Committee urges members to plan their vacation and travel schedules so that they will be able to take in the Cleveland Convention.

Cleveland Convention Committee meets to further plans for a banner program next May. Beginning at near corner and proceeding clockwise around the table are: A. D. Yanda, M. A. Fanelli, J. B. Scalzi, M. E. Friedman, W. B. Auping, D. C. Mardorf, W. B. Hanlon, Mrs. A. D. Yanda, Section President M. J. Phillips, Don Reynolds (of ASCE Headquarters), General Chairman W. R. Swatosh, Section Secretary J. M. Hicks, W. E. Donaldson, G. B. Bodwell, J. R. McKinney, G. B. Earnest, and L. Osborn (representing the Cleveland Hotel).



The Younger Viewpoint

The Voice of the Committee on Junior Member Publications

Committee on Junior Member Publications

Milton Alpern, Chairman; 3536 Northview Ave., Wantagh, L. I., N. Y.

Zone I	Zone II	Zone III	Zone IV
Louis K. Walter, Jr. 320 Market Street Kenilworth, N. J.	Raymond S. Gordon State Planters Bank Building Richmond, Va.	Walter D. Linzing 4751 No. Paulina Chicago 40, Ill.	Rodney P. Lundin 9744 Quakertown Ave. Chatsworth, Calif.

Beginning with this issue, The Younger Viewpoint will be interpreted by a different Zone committee member each month. Walt Linzing, of Zone III, starts the ball rolling fast:

How About Your New Year's Resolutions?

Greetings to all engineers with the younger viewpoint in 1959! As the time for New Years' resolutions is still fresh, shouldn't we as engineers consider a few? How about concentrating on a few of these? . . . participation in community affairs (school boards, zoning boards, neighborhood improvement and planning commissions, etc.) . . . What can I do for my engineering society? This could be the year that I can serve on that committee . . . this could be the year that I will write that ASCE technical paper I've been thinking about . . . politics, bond issues—as an engineer my opinions, evaluations, etc., should be known. . . . Why not run for public office? . . . Professional engineer examination this year? Why not? . . . and, oh yes, how about writing that letter you've been thinking about for The Younger Viewpoint?

'Tis Better to Give Than to Receive

And let's remember while we are making resolutions that whatever we turn our attention to, the more we give, the more we receive. Just as in the case of an electric motor, the higher the input the greater the output. As discussed at the recent ASCE Convention in New York, many ASCE members think too much in terms of, "But what do I get out of ASCE?". Why not *try giving first*, putting yourself actively in ASCE, you may be amazed at the results, try it! The prestige of the American engineer will be greatly enhanced if we dynamically assert ourselves as a profession and as professional men. We have never had a greater opportunity than now in the Sputnik and Nuclear Age. As never before, the time is right to put our abilities and our thinking into orbit.

Heard From the Junior Members

Hasan Makarechian, of Chicago, is wondering why it has taken six months to process his application for membership in ASCE. Now a member of the Society, he hopes that others have not had to wait as long to engage in Society activities.

Also Heard—Why Not Junior Members for ASCE National Directors?

Another Chicagoan, William Walker, has raised an interesting question: "Why can't Junior Members run for national Directors in the ASCE?" A search of the ASCE constitution and bylaws as printed in the 1958 Official Register has revealed that there are no restrictions in grade for the election of Society officers including Directors. Nineteen Directors are called for in the constitution. "Vice Presidents and Directors shall be nominated by the members of their respective Zones and Districts. . . . Nomination and election of Directors shall be made by the members in their various Districts," according to Article VI of the constitution. Details on nomination ballots and election are given in Article V of the bylaws, ". . . The two nominees for each office, Directors and Vice Presidents, who receive the greatest number of nominating votes shall be the official nominees for that office, provided that no nominee who receives less than 5 percent of the votes cast for nomination to that office shall be designated an official nominee . . ." Mr. Walker notes that since 43 percent of the ASCE membership consists of Junior Members, they should be represented more in the Society and should elect qualified Junior Members to national directorships. Mr. Walker feels that such representation would spark more interest in the Society and encourage younger engineers to take a more active part in its activities.

Answer This Question if You Can

Past-President Louis R. Howson raised some questions a year ago upon taking office as the head of ASCE. Some of the questions as noted in the November 1957 issue of CIVIL ENGINEERING still require answers. How about some answers from those of you with the Younger Viewpoint? How about your comment on: "Why do so few ASCE members attend and participate in our Conventions?" Mr. Howson noted that, "While ASCE, with 14 Technical Divisions, draws but 2 percent of its members to its Conventions, other societies serving a single segment of the profession consistently attract 20 percent or more of their membership to their conventions." What is your answer, your suggestion?

Engineers as Citizens

As engineers are we fulfilling our duties in citizenship? A case in point appeared in an editorial in the November 1958 issue of *Public Works Magazine*. The particular discussion involved the fluoridation situation in New York City. It was stated that although a number of

local engineering groups, and many national engineering society headquarters are located in New York City, not a single one appeared on a recent list of community and scientific organizations endorsing fluoridation. Medical, dental, welfare, business and scientific groups were represented, but not engineering. Now it may be for some reason engineers were against it, maybe not. The editorial notes that failure to speak is often interpreted as opposition. "The public looks to local engineers and engineering groups for guidance on engineering problems," *Public Works* states. Why don't we supply such leadership? Is it unprofessional? If so, why? If in disagreement with a public works program or contemplated construction project, is it better to remain silent? Doesn't professionalism entail increased citizenship responsibilities? Aren't we in a better position to judge such programs? What do those of the Younger Viewpoint think of such matters? Send your answers to any of the committee members listed on our masthead.

Attention Local ASCE Chapter Presidents

The members of the Committee on Junior Member Publications solicit the help of Local Section presidents in advancing the work of the committee. If the presidents will appoint a contact man in their Section to send articles and correspondence to The Younger Viewpoint committee members, this column can become a real force and a representative sample of opinion in the ASCE. Best wishes to each of you for a successful program in 1959. Upon each of you rests the opportunity to make this the best year yet for ASCE.

Death Takes Two Honorary Members

Charles F. Kettering

In the death of Honorary Member Charles F. Kettering, which took place in Dayton, Ohio, on November 25, the Society lost one of its most famous members. Mr. Kettering, who was 82, was known the world over for his inventions and research achievements. Called "one of the fathers of twentieth century technology in the United States," he made many fundamental research discoveries in his own laboratories, the Dayton Engineering Company. In 1920 he began a long connection with General Motors. For many years he was vice-president and head of the research division, and he continued to serve as research consultant to the company after his retirement in 1947.

Mr. Kettering held 140 patents on his own inventions and on improvements on the inventions of others. His own inventions included the self-starter for automobiles, one of the most important contributions to the development of the motor vehicle. He developed ethyl gasoline, four-wheel brakes, safety glass, the diesel locomotive, high-compression automobile engines, and a whole line of electrical equipment for farm machinery. Mr. Kettering also knew the value of fundamental research and, in recent years, had been devoting the fortune he made from his inventions to establish foundations for scientific and medical studies. One of his most famous projects was his co-sponsorship with Alfred P. Sloan, Jr., of the Sloan-Kettering Institute for Cancer Research in New York City.

Becoming a member of ASCE in 1937, Mr. Kettering was made an Honorary Member in 1945. One of his most recent services to the profession was as honorary chairman of the Member Gifts Campaign for the new United Engineering Center, a position he held at the time of his death.

Wilbur M. Wilson

Wilbur M. Wilson, Honorary Member of the Society and distinguished engineering educator, died in Urbana, Ill., on November 28, at the age of 77. For almost half a century his career was closely identified with the University of Illinois Department of Civil Engineering, and at the time of his death he was research professor of structural engineering emeritus. A 1900 graduate of Iowa State College, he went to the University of Illinois in 1913 and served there continuously until his retirement in 1949, except for two years of wartime service as an engineer officer in the Army. He earned a master's degree from Cornell University in 1904 and received the honorary degree of doctor of engineering from Iowa State College in 1942.

Professor Wilson's work included studies of the application of the slope-deflection method to the analysis of statically indeterminate structures, and experimental studies of concrete arches, the bearing value of large rollers, the static and fatigue strength of riveted and welded structural joints, and the strength of cylindrical shells. He played an important part in the development of high-strength bolts as a structural fastener, mainly as a replacement for rivets.

Professor Wilson was holder of many honors, including the Chanute Medal of the Western Society of Engineers, the Wason Medal of the American Concrete Institute, and the Society's J. James R. Cross Medal. In 1950 he was made an Honorary Member of ASCE, which he had served as Director from 1944 to 1947. He represented ASCE as one of the science observers at the Bikini Atomic Bomb Tests in 1946.

U.S. Supreme Court Supports EJC Brief

Of great interest and concern to all professional employees is a ruling of the U.S. Supreme Court, made on December 15, in favor of the engineers in connection with an action before the U.S. District Court for the District of Columbia. Some time ago the Labor Legislation Panel of Engineers Joint Council, acting under instruction from the EJC board, arranged for filing a brief on behalf on EJC, as a friend of the Court, in connection with action before the U.S. District Court for the District of Columbia. The action was brought by the Buffalo Section, Westinghouse Engineers Association, Engineers and Scientists of America, against the National Labor Relations Board.

The case developed as the result of a NLRB ruling that a collective bargaining unit including both professional and non-professional personnel was appropriate in spite of the fact that the professional people involved were denied the privilege of deciding by majority vote whether they desired such heterogeneous grouping. The plaintiff protested the action of the NLRB and requested the court to direct the Board to vacate its decision. Taking the position that the NLRB ruling was in direct violation of the professional employee provisions of the Taft-Hartley Act, the EJC brief supported the position of the plaintiff.

The NLRB had petitioned the U.S. Supreme Court for a hearing in the case, after rulings had been given in favor of the plaintiff by both the U.S. District Court for the District of Columbia and the U.S. Court of Appeals for the District of Columbia.

Division Doings

Air Transport Division's executive committee meets with Houston engineers to plan Second Jet Age Airport Conference, which will be held in Houston next May. Chairman Robert Horonjeff discusses the proposed program with (seated in usual order) H. M. Shilstone, Jr., R. M. White, Joseph D. Blatt, and William M. Beadie. Standing for the picture taking are four other participants in the planning: Robert D. Collier, John M. Kyle, Reginald Sutherland (general conference chairman), and Don P. Reynolds.

Brain and Computer Compared at Electronic Conference

A luncheon was one of the features of the Conference on Electronic Computation. At the head table were (left to right) Jack F. Daily, Kansas City Section board contact member; Norman Dalkey, keynote speaker for the Conference; Josef Sorkin, general chairman of the Kansas City Section committee; Elmer K. Timby, featured luncheon speaker; Nathan M. Newmark, chairman of the Structural Division's Committee on Electronic Computation; Ronald M. White; George S. Vincent; Jackson L. Durkee, program chairman; and Stephen J. Fenves.

Fairly unusual for an engineers' conference was the strain of philosophy running through the program of the first ASCE Conference on Electronic Computation held in Kansas City, Mo., in November. Because comparisons between the human brain and electronic computing devices are inevitable, the conference sought ways in which one might supplement the other in the solution of structural problems. Structures were emphasized because the Structural Division was one of the co-sponsors, along with the Kansas City Section.

Assembling from 38 states and several foreign countries, 525 engineers met at the conference to ask questions and to attempt answers. One such question, raised by luncheon speaker Elmer K. Timby, one of the pioneers in this area, was, "How will electronic computers affect the personality and professional performance of the civil engineer?" Mr. Timby, a New York City consulting engineer, pointed out that the computer will relieve the engineer of much drudgery and present a challenge "to utilize positively the creative talent that he will now have time and tools to develop." Mr. Timby concluded that engineers are going to have more time to influence the end product of their creative talents and must accept this opportunity.

That the brain is "an internally programmed computer" was the point made by Norman Dalkey, the keynote speaker. Mr. Dalkey, who directs planning analysis for the Air Force, told how the computer developed, what it can do now (which is quite exciting), and predicted what it will be able to do in the foreseeable future—including the ability to think. One inescapable conclusion came out of Mr. Dalkey's talk: Computers have developed so rapidly and offer such promise that engineers must learn how to use them effectively and economically.

Practical Applications Described

Not all the six sessions were concerned with philosophy. A variety of specific applications to engineering problems were discussed. These ranged from such down-to-earth applications as solutions for rigid frames and column buckling to the "Analysis of Space Structures." Designers, who have used the computers, showed how they "program," code, and compute such tedious problems as continuous I-beams, girders, columns, trusses, etc. The solutions so often depend upon the happy selection of proper mathematical methods that special attention was given to computer solutions of algebraic equations, numerical integration, matric formulation, and such.

Economics the Tough Nut to Crack

To the majority of those attending, one question loomed larger than all the rest. How can we afford this new luxury? The high cost is in both the equipment and personnel who are qualified to "program," code and compute. As one consultant pointed out, it sometimes costs $35,000 to "program" one problem. The solution is found in using the same program over and over again for similar solutions. The Structural Division's Committee on Electronic Computation is seeking a practical method of exchange of programs to further cut costs.

As chairman of the Committee on Electronic Computation, Nathan M. Newmark expressed the opinion, "Advantages of ready access to many prepared programs must outweigh the value of ownership of a few." Continuing study will be given the situation. Much of the information presented at the conference will appear in publications of the Society.

As chairman of the Committee, Dr. Newmark coordinated plans for the conference. The general chairman was Josef Sorkin, of the Kansas City Section Committee, and the program chairman was Jackson L. Durkee.

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

ASCE CONVENTIONS

LOS ANGELES CONVENTION

Los Angeles, Calif
Hotel Statler
February 9-13, 1959

CLEVELAND CONVENTION

Cleveland, Ohio
Hotel Cleveland
May 4-8, 1959

ANNUAL CONVENTION

Washington, D. C.
Hotel Statler
October 19-23, 1959

TECHNICAL DIVISION MEETINGS

JET AIRPORT CONFERENCE

Houston, Tex.
Shamrock-Hilton Hotel
May 20-22, 1959

Sponsored by
ASCE Air Transport Division
Houston Branch of
Texas Section

HYDRAULICS CONFERENCE

Fort Collins, Colo.
Colorado State University
July 1-3, 1959

Sponsored by
ASCE Hydraulics Division
Colorado Section
Colorado State University

LOCAL SECTION MEETINGS

Hawaii—Post-Convention Tour of the Islands, February 16-25. Tour headquarters will be the Reef Hotel, Honolulu. For information write, Reservations Committee, P. O. Box 8084, Honolulu, Hawaii.

Illinois—Weekly luncheon meeting at the Engineers Club, Chicago, every Friday at 12 noon.

Los Angeles—Junior Member Forum social hour and dinner at the Engineers' Club in the Biltmore Hotel on January 22 at 6 p.m.; dinner meeting of the Soil Mechanics Group at the Rodger Young Auditorium on January 21 at 6:30 p.m.; social hour and dinner meeting of the Construction Group at Michael's Restaurant on January 22 at 6:30 p.m.; reception and dinner meeting of the Transportation Group at the Engineers' Club in the Biltmore Hotel on January 22 at 6:30 p.m.; dinner meeting of the Santa Barbara-Ventura Counties Branch at the El Presidio Restaurant on January 20 at 7 p.m.

Massachusetts— Annual meeting and election of officers at the M. I. T. Faculty Club on January 19 at 6:30 p.m. Wives are invited.

Metropolitan—Meeting in the Engineering Societies Building, January 19, at 7 p.m. Executive Secretary Wisely will moderate a panel discussion on "Professionalism in Medicine, Law, and Engineering."

Philadelphia—Meeting on the Problems of Design and Construction in the Arctic at the Engineers' Club on February 10 at 7:30 p.m.; meeting of the Construction Division at the Engineers' Club on March 25.

South Carolina—All-day meeting at the Columbia Hotel, Columbia, S. C., January 16.

Syracuse—Regular monthly dinner meeting at Drumlins on January 20 at 6:30 p.m.; joint meeting with the Syracuse University Student Chapter at the university on February 17.

Virginia—Norfolk Branch meeting the third Monday of every month at the YMCA Cafeteria at 12 noon; Richmond Branch meeting the first Monday of every month at the Hot Shoppe Cafeteria at 12:15 p.m.; Roanoke Branch meeting the second Wednesday of every month in the S & W Cafeteria at 6:30 p.m.

The new president of the **Arizona Section** is Robert M. Cushing. Other new officers are Edward C. Fraedrich, second vice president; and Robert G. Welman, secretary-treasurer. Leon H. Tolleson and Glen C. Bush are junior members of the Board of Directors.

At the helm of the **Columbia Section** for the coming year are Bertram W. Hoare, president; George H. Bauer, first vice president; George C. Richardson, second vice president; and Russell R. Ekstrom, secretary-treasurer.

The **Georgia Section** reports a large and enthusiastic turnout for its November luncheon meeting. Featured speaker was Dr. Robert J. Anderson, assistant surgeon general and chief of the Communicable Disease Center at Atlanta. Dr. Anderson explained what the Center is doing and the many problems involved in its operation.

The annual Ladies Night meeting of the **Northwestern Branch** of the **Indiana Section** was well received by the women, each of whom received a corsage. The speaker of the evening Dr. Ralph M. Melaven, of the Standard Oil Company of Indiana, discussed the geological history of the Great Lakes area.

At head table at joint dinner meeting of the Kansas City Section of ASCE and the Kansas City Chapter of the Society of American Military Engineers are, in usual order, Maj. J. P. Barnes, deputy Kansas City district engineer and president of Kansas City Chapter of SAME; Brig. Gen. Paul D. Berrigan (retired), technical consultant to the Calumet-Sag region of the St. Lawrence Seaway project and featured speaker; Col. L. E. Laurion, Kansas City district engineer; and Lawrence M. Bremser, president of the Kansas City Section of ASCE.

Pictured at recent meeting of Vermont Branch of Maine Section are G. R. Pyper, secretary-treasurer, Vermont Branch; W. H. Wisely, Executive Secretary, ASCE, and featured speaker; R. W. Thieme, president, Vermont Branch; and S. C. Knight, vice president, Vermont Branch.

Cincinnati Section honored eleven past presidents of the Section at its November dinner meeting. Here Hunter W. Hanly, the oldest past president, congratulates William G. Hamlin, the current president. Looking on are Past Presidents Carl F. Renz, Warren W. Parks, Lewis G. Hexem, Emil S. Birkenweld, Harry A. Balke, Truman P. Young, Ray Raneri, Professor Cornelius Wandmacher, Professor Raymond W. Renn, and George J. Kral. Featured speaker was Howard Jacoby, formerly a senior editor of the "Engineering News-Record" and currently chief computer services engineer for Photronix, Inc., Columbus, Ohio, who spoke on "Engineering Communications."

Engineering unity was the principal topic at the **Iowa Section's** fortieth annual meeting. William H. Wisely, Executive Secretary of ASCE, discussed the ASCE concept of engineering unity. At an executive committee meeting earlier in the day he had pointed out that the Section's stated new policy of referring such matters as professional ethics, public relations and legislation to the Iowa Engineering Society and leaving ASCE to handle technical matter was contrary to ASCE policy. A motion was passed rescinding the policy.

Frederick S. Snow, prominent engineer of London, England, addressed a recent **Kentucky Section** meeting on Great Britain's engineering organizations and on reinforced and prestressed concrete structures recently completed in England and abroad. Mr. Snow met with the Student Chapter at the University of Kentucky.

Recent meetings of the **Lehigh Valley Section** included a talk by Demenico Annese on "Engineering Aspects of Bethlehem Redevelopment" and a forum on structural engineering material. Mr. Annese, a landscape architect with the New York firm of Clarke and Rapuano, elaborated on the various phases of the redevelopment plan, especially the slum clearance and rehabilitation of the Monocacy Creek area, and the new civil center and City Hall. The forum, headed by Fred N. Severud, of Severud-Elstad-Krueger Associates, New York City, heard C. C. Singleton, regional structural engineer of the Portland Cement Association, explain the many applications of concrete construction in prestressed girders and barrel-and-shell roofs. Another member of the panel, Howard Estes, assistant director of research for the American Institute of Steel Construction, singled out the development of high-strength bolts as evidence of the high quality of research sponsored by the steel industry. The third member of the panel, Herbert Stemler of the Aluminum Company of America, concluded by listing new uses of aluminum in construction and highway applications.

Rear Admiral Peltier, chief of the Bureau of Yards and Docks, spoke at a recent meeting of the **Los Angeles Section.** He made several pertinent observations concerning U. S. naval installations and the duties of the Bureau. Admiral Peltier outlined the pending costly changes in shore establishments necessitated by the introduction of electronic nuclear-type weapons. Equally significant is the technical assistance the Bureau renders the fleet and the work of the Seabees in areas where it is impracticable for private contractors to work.

BY-LINE WASHINGTON . . . . .

The Democratic party has formally announced the general outlines of its next two-year legislative platform. For engineers it will be a boomer!

Uncle Sam must get into the complex urban public works problem rapidly and wholeheartedly, the political strategists say, and Federal aid should be employed as heavily in rebuilding Eastern cities as it has been in solving the power and reclamation problems of the West. This means all kinds of community facilities—expressways, airports, water and sewage systems, and public housing.

The Democrats will push for enactment of a self-financing TVA bill permitting expansion of Tennessee Valley projects, for a sizable increase in funds for atomic energy power plants, and for a Columbia River development program.

(Next month will see specific legislation introduced to implement these ambitious plans.)

* * *

The major problem of obtaining more federal aid for the National Highway Program will face Congress this session, also. Although the "pay-as-you-go" provision of the 1956 Federal-Aid Highway Act was suspended to permit full apportionment of the huge authorizations of 1959 and 1960, officials here see a cutback of the road-building effort if more revenue sources are not tapped. The highway-user taxes drafted to support the multi-billion-dollar program were just not adequate. That, plus the fact that the estimated cost of constructing the 41,000-mile Interstate network has gone up from $27 billion to well over $41 billion, has the highway industry worried.

Already, highway user groups are denouncing proposals to boost the fuel taxes. The American Automobile Association, the American Trucking Associations, and the Grange have declared there must be no additions to the burden of the highway user. (Maurice Stans, Budget Director, announced several weeks ago that this is the solution the Administration would propose.)

* * *

Meanwhile, construction proceeds apace on the National Interstate System. Contract awards leaped nearly 50 percent in 1958, to $1.6 billion from $1.1 billion in 1957. It is almost impossible to gauge the progress which state highway departments are making in the initial operations—preliminary engineering and right-of-way acquisition. So contract awards for 1959 are something officials won't predict.

Right now, billions of dollars are inching their way through channels. As of November 1, the federal government had distributed about $7.5 billion among the states since the program began. Of this, $2,657 million was under construction or already completed; $553.3 million was at the contract-advertising stage; $1,728 million had been authorized for preliminary engineering and right-of-way; $1,137 million had been programmed only; and $2,360 million was still untapped by any kind of state action.

* * *

Congress will be asked for the money this session to launch several water de-salting projects. Civil engineers expect to be building numerous such plants in years to come. The pilot installations under consideration will reveal the economic feasibility of such processing and the engineering features necessary.

Five complete demonstration plants were authorized last session—two to convert inland brackish water and three for sea-water processing. In time, engineers here say, huge plants capable of producing more than 20 million gallons of water a day will be constructed along our seacoasts. Long pipelines will be laid to carry the output far inland into arid areas. Already, officials report, the cost of de-salting water has been reduced to $1.75 per thousand gallons.

A joint research project to determine if nuclear energy can be harnessed to this kind of operation has been initiated by the U. S. Office of Saline Water and the State of California. If this approach proves feasible, a full-scale $70 million plant may be constructed.

* * *

The U. S. Army Corps of Engineers has reported results of its test of a new heavy-duty asphalt paving design for Air Force runways. In testifying before the Congressional Committee that ordered the investigation, Gen. Walter K. Wilson said the ascelerated traffic test (5,000 passes of a 212,000-lb) test vehicle to simulate 20 years of normal B-52 traffic) demonstrated the validity of the Corps' design for an adequate asphalt pavement.

This was the issue which prompted an order for the test about 18 months ago. The Air Force insisted on a preference for Portland cement concrete; asphalt interests were protesting the policy; and the Corps (construction agent for the Air Force) indicated it had designs for a heavy asphalt pavement which could bear B-52 traffic.

The Corps told the Congressmen that their design has now been proved adequate for landings and take-offs. However, the engineers said that a certain amount of taxiing on the runway might justify the Air Force's request for a 75-ft-wide center strip of Portland cement concrete.

This compromise proved distasteful to both Portland cement and asphalt interests. Spokesmen for the Portland Cement Association attacked the asphalt test results with the claim that materials used were superior to those normally in supply, that an unusually thick structure was designed, and that the durability of the pavement under weathering was not determinable from the test.

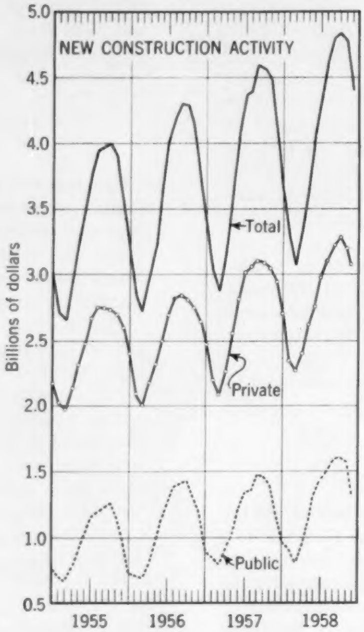
NEWS BRIEFS . . .

Construction Activity Declines Slightly in November

New construction activity in November declined less than seasonally to $4.4 billion, according to preliminary joint estimates of the U. S. Departments of Commerce and Labor. The total dollar volume for the first eleven months of 1958, at $44.9 billion, exceeded the comparable 1957 period by a slight margin.

Public construction thus far in 1958, at $13.9 billion, was 6 percent above a year earlier, due mainly to continued strength in public housing and highways. Private expenditures, amounting to $31 billion, were slightly below the total for the same 1957 period, as gains in housing and most types of nonresidential construction were more than offset by the sharp decline in industrial building.

Monthly estimates are determined primarily by past contract award movements, standard progress patterns, and assumed normal seasonal movements. Except when special surveys are made, the estimates do not reflect the effects of varying numbers of working days in different months, nor of special conditions influencing the volume of activity in any given month, such as unusual weather, materials shortages, overtime, work stoppages, and postponements. Month-to-month measures of current construction activity are employment, hours of work, and unemployment. Other general indicators of future trends in activity are housing starts, contract awards, building permits, and materials output. Analyses of trends of activity should consider all of these interrelated factors.



Construction activity in November declined less than seasonally to 4.4 billion. Dollar volume for first eleven months exceeds comparable 1957 total by slight margin.

Dresden Nuclear Station Receives First Fuel

The first shipment of nuclear fuel for the Commonwealth Edison Company's Dresden Nuclear Power Station has arrived at the plant site eight miles east of Morris, Ill. The shipment, valued at approximately $1,700,000, was made by the General Electric Company, builder of the plant, from its nuclear fuel fabricating facility at San Jose, Calif. A single truck made the delivery consisting of 54 bundles of enriched uranium pellets clad in zirconium tubing. These bundles are the first of 488 that will be required for full initial fueling of the Dresden reactor. Valued at about $15,400,000, the full loading will produce as much electricity as 1,800,000 tons of coal.

The 180,000-kw Dresden plant, which is scheduled for operation in 1960, is being built by General Electric for a contract price of $45,000,000. Commonwealth Edison, which will own and operate the plant, is paying $30,000,000 of the contract price, plus site and overhead costs. Associated with Commonwealth in paying the rest of the cost as a research and development expense are the American Electric Power Company, the Bechtel Corporation, the Central Illinois Light Company, the Illinois Power Company, the Kansas City Power and Light Company, the Pacific Gas and Electric Company, and the Union Electric Company.

Dresden will be the first full-scale, privately financed atomic power plant to come into operation in the United States. Its nuclear power reactor is the largest under construction in the country.

First Raymond Award Goes to Civil Engineer

Martin S. Kapp, J.M. ASCE, is the winner of the first annual Alfred A. Raymond Award of $1,000 for his paper describing a new technique of soil consolidation. Sponsored by Raymond International, Inc., and named after the founder of the firm, the award was established "to encourage originality in research and development in the field of foundation engineering."

Mr. Kapp, a soils and foundation engineer for the Port of New York Authority, described a novel use of wellpoints to lower the water table temporarily for the purpose of consolidating a large area of unstable soil. The method was used instead of a conventional surcharge fill. The paper, entitled "A New Technique for Stabilizing Compressible Soils," points out that lowering the ground-water level eliminated soil buoyancy, with the result that an overlying sand blanket increased in weight and effectively compressed an underlying stratum of soft silt.

Two honorable mentions were also awarded. One went to Charles W. Granacher, M. ASCE, of the Dravo Corporation; the other was shared by James F. McNulty, A.M. ASCE, and James S. O'Brien, J.M. ASCE. The awards were selected from twenty-nine entrants. Presentation of them took place at a dinner held in the Waldorf-Astoria on December 16.

Martin S. Kapp receives first Alfred A. Raymond Award for best paper on foundations from Maxwell M. Upson, chairman of the board of Raymond International, Inc., sponsor of the award.

Request for Uniform Small Home Building Code Rejected

At a meeting held on November 17 the American Standards Association turned down a request for the initiation of a standardization project for the development of uniform building code requirements for one and two-family houses that could be adopted by communities throughout the United States.

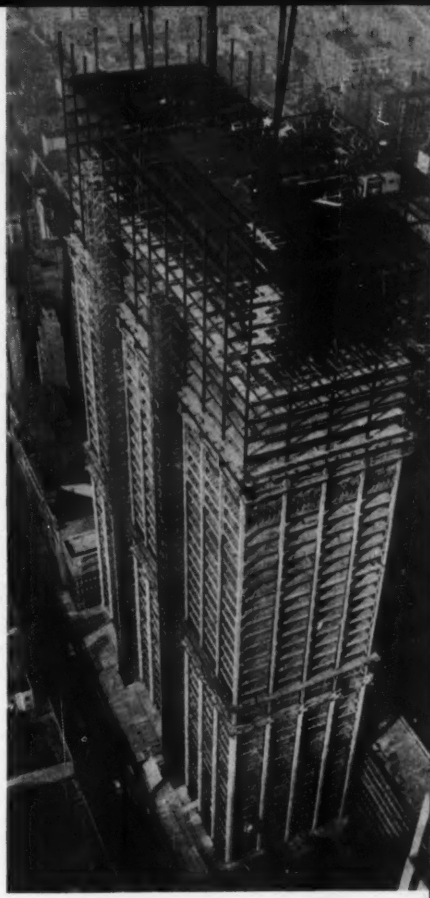
"We found that there was no consensus among the national groups and organizations substantially concerned as to the desirability of starting such a project under the procedures of the American Standards Association," said Lloyd Barron, chairman of the association's Construction Standards Board.

The proposal, which has received much attention in the daily press and trade publications, was submitted to the American Standards Association last June by publisher Henry R. Luce on behalf of fourteen national organizations interested in cutting down the cost of home building.

Subsequent balloting—at a conference held in September and by letter ballot prior to the November meeting—failed to produce enough of a consensus to justify initiating such a project. According to Mr. Barron, "the negative votes included those of three of the leading code-writing organizations—the Building Officials Conference of America, the International Conference of Building Officials, and the Southern Building Conference. Also opposed were many of the building materials industries."

New Time and Life Building Topped Out

Erection of a fully lighted Christmas tree featured topping out ceremonies on November 25 for the new 48-story Time and Life Building in New York City's Rockefeller Center. The building, which contains 31,224 tons of structural steel, was field connected for the most part with high-strength bolts. Fabricated and erected by the Bethlehem Steel Company, the structure includes column sections weighing up to 32 tons and measuring about 36 ft in length. Columns for the tower section are located on the outside of the building with connecting steel on the inside facing to permit straight uncluttered interior curtain walls. The structural engineer is Edwards and Hjorth, and the architect Harrison & Abramovitz and Harris. The joint contractors are George A. Fuller and John Lowry.



ASCE Member President of Institution of Civil Engineers

A. J. S. Pippard, M. ASCE, professor emeritus of civil engineering at London University, took office in November as ninety-fourth president of the Institution of Civil Engineers (of Great Britain). In his inaugural address, Professor Pippard said, "We are part of a new scientific world, and our survival as leaders in it will depend upon the extent to which we can adapt our outlook and methods to changing circumstances." One of the most significant developments of the postwar era, as he sees it, "has been the extension of technological education to the postgraduate stage."

Professor Pippard referred to his experience at Northwestern University where he served as visiting professor in 1956. Describing the postgraduate evening classes there—arranged for the convenience of engineers employed during the day—Professor Pippard asserted he was "converted to the view that it would be well if we shed some of our prejudices against evening work in the universities and tried to experiment with some of our own postgraduate classes."

A. J. S. Pippard

The increasing and widespread demand for advanced study, Professor Pippard said, especially in the United States and the Soviet Union, warrants "serious concern about our future standing in relation to other nations in the number of our [British] technologists."

Enhanced status for the profession, he believes, "will come by the loyal cooperation of all its members in its corporate work of increasing knowledge of both theory and practice."

Argonne Low Power Reactor Dedicated

Dedication of the Argonne Low Power Reactor (ALPR) took place on December 2 at the site of the Atomic Energy Commission's National Reactor Testing Station near Idaho Falls, Idaho. A prototype of small boiling water reactors suitable for operation in remote locations, the ALPR is designed to produce 200 kw of electricity and the equivalent of 400 kw for space heating. Among new features included in the design are: (1) an air-cooled condenser for remote sites with limited water supply; (2) gravel shielding to minimize the requirements for pouring concrete; and (3) application of aluminum-clad fuel elements for a high-temperature power-producing reactor. The Pioneer Service & Engineering Co., of Chicago, Ill., served as architect-engineer under subcontract to the Argonne National Laboratory on the low power reactor.

Since 1952 Pioneer has been conducting nuclear power investigations for a group of ten electric utilities. The study resulted in the formation of the Central Utilities Atomic Power Associates and negotiations for the construction of the Pathfinder Atomic Power Plant near Sioux Falls, S. Dak., for the Northern States Power Company. Pioneer is the architect-engineer for the Pathfinder Plant, which will be designed and built by the Allis-Chalmers Manufacturing Company. The Pathfinder will utilize an advanced type of boiling water reactor to supply steam for the 66,000-kw turbine generator. The plant is scheduled for completion in 1962.

Should Private Firms Plan Public Works?

Increased participation in public works by private engineering firms is strongly advocated by Robert Moses in an important article in the New York Times Magazine of November 16. The article—entitled "Should Private Firms Plan Public Works?"—makes it clear that big construction jobs cannot be designed and supervised by government personnel alone, despite increased pressure "in various parts of the nation . . . to use only permanent Civil Service technicians in the preparation of engineering, architectural, landscape and related plans and specifications for public works and for supervision of construction of such works."

Says Mr. Moses, "Let me offer an example of the drive for exclusive government planning. In connection with the vast new Federal Aid Highway Program, involving some $50 billion over a period of twelve years, and especially the 41,000-mile interstate network, there has been serious discussion at various meetings of state highway officials of the question of eliminating private firms. The adoption of such a policy, if it were followed by legislation to put it into effect, would in my opinion go far toward ruining this great program, especially in the urban areas of the nation." Furthermore, he adds, "it would inevitably spread into the design and inspection of other public works, including slum clearance, housing, power, bridges, parks, and every conceivable kind of construction carried out or aided by public funds."

Asserting that both government engineers and outside consultants have their place in the public construction picture, Mr. Moses noted that, "Government employees must take care of budgeting of programs, routine construction, overhead policy decisions, supervision, review and coordination of plans, maintenance and other essential overhead work. Thereafter, the use of outside professional firms and technicians is the logical and economical method of progressing engineering and architectural design and supervision of most large construction projects."

Mr. Moses warns that, "Permanent government engineering organizations recruited to handle huge construction programs acquire rights, privileges, and protection under laws which make it impossible to tailor their size to current needs . . . The costs of engineering, design, and inspection by government agencies run up to 18 percent of estimated construction costs, according to surveys made by the Hoover Commission in its second report, as against an average of 4 percent for design and 4 percent for inspection ordinarily paid to private consulting firms who have to meet their entire overhead bills and pay full taxes."

"These Hoover studies of $8 billion worth of construction concluded: 'By contracting to private architect-engineer and construction organizations all phases of design and construction work on Government construction projects, relatively small supervisory engineering organizations in the executive agencies could furnish the preliminary study, preplanning, and budgeting, and the supervisory management and control essential for all Government projects, without maintaining through periods of fluctuating demands the present costly overhead for complete engineering and construction staffs. . . .' "

The full text of Mr. Moses' article is available from W. J. Donoghue Associates, 10 Columbus Circle, New York 19, N. Y.

New Suspension Bridge Connects U.S. and Canada

All St. Lawrence River shipping to and from the Great Lakes will pass under this new International High Level Bridge, opened to traffic on December 1 at the head of the St. Lawrence Seaway Project. The bridge, connecting the United States and Canada at Massena, N. Y., has an overall length of 3,480 feet with a suspension span of 1,800 ft. The towers, 900 ft apart and 215 ft high, provide 130-ft vertical clearance for the navigation channel. The American Bridge Division of U. S. Steel built the bridge without accident in a construction period of six months, establishing a record for safety and speed.

Crosstown Expressway For Lower Manhattan

Long-debated plans for a Lower Manhattan Expressway seem likely to be realized, now that city and state officials have finally ironed out their differences. Plans for a $77,919,200 crosstown expressway, which would connect the Holland Tunnel and the West Side Highway with the Manhattan and Williamsburg Bridges, have been forwarded to the Federal Highway Administrator for approval. After this approval has been obtained, the Board of Estimate must adopt the project. At present the only obstacle foreseen is possible objection from owners of the $31,000,000 worth of property that must be acquired.

The ten-lane expressway will be the first crosstown elevated vehicular highway in Manhattan. It will be elevated for its entire 2½-mile length except for a depressed approach to the Williamsburg Bridge. Its course east, after leaving the Holland Tunnel plaza and ramps to the West Side Highway, will be mainly on Canal and Broome Streets. These streets are to be widened, with the expressway in the middle.

The capacity of the new expressway will be 13,800 vehicles an hour, seven times the present capacity of traffic-clogged Canal Street. Truck and passenger-car traffic will be separated. It is expected that the route will attract much new traffic from Long Island by way of the Brooklyn-Battery Tunnel, which connects with both the West Side Highway and the East River bridges. If final approval of the five-year project is obtained, work on it will probably start this spring.

Madigan-Hyland are consulting engineers for the New York State Department of Public Works, which will supervise the project. The state will pay 10 percent of the cost, and the Federal Government 90 percent. The expressway will be incorporated in the new national highway network.

Over $50 Billion in Construction Spending Foreseen for 1959

Construction in 1959 is expected to pass the $50-billion mark for the first time. In outlook estimates prepared jointly by the Departments of Commerce and Labor, the two agencies forecast a 7 percent rise in spending for new construction next year to a record $52.3 billion. The expected outlays also reflect a new high in physical volume of work put in place (expenditures adjusted for price changes), exceeding the previous peak attained in 1955 by 3 percent.

As the joint agencies see it, public expenditures will provide the major part of the 1959 expansion in new construction—rising by $2.1 billion to $17.1 billion. The $35.2-billion total foreseen for private construction represents a gain of $1.4 billion over 1958. Most of the $3.5-billion increase in construction expenditures in sight for 1959 will be in residential building (public and private) and highways. Together these groups will account for almost four-fifth of the advance.

Well over half the advance in public construction outlays for 1959 will be financed by the Federal Government. Anti-recession measures and re-evaluation of defense programs have resulted in acceleration of projects, rising contract awards, and large appropriations during 1958, which will result in sizable increases in the amounts spent on direct Federal and Federal-aid construction in the coming year. Prospects are for a 12-percent rise in highway construction to $6.0 billion. All the increase will be in federal funds, though state and local highway outlays will remain close to 1958 levels.

Expenditures for military facilities are expected to rise 16 percent to $1.4 billion, following a two-year decline. This expansion will be chiefly for the construction of long-range ballistic missile bases and dispersal bases for the Strategic Air Command.

An 8-percent expansion of conservation and development programs foreseen for 1959 will continue the uptrend that began in 1956 and will push such expenditures to a new high of $1.1 billion. A large part of the increased Bureau of Reclamation outlays will be for expanding work on projects already underway, notably Glen Canyon Dam. Work under the Corps of Engineers will include dredging the Great Lakes channels to St. Lawrence Seaway depth and such multi-purpose projects as the Oahe Reservoir on the Missouri River and the Ice Harbor Lock and Dam in Washington, which are approaching peak activity.

Cornell Students Winners in Lincoln Prize Competition

Five engineering undergraduates at Cornell University received all the top awards in this year's annual welded design competition for undergraduates sponsored by the James F. Lincoln Arc Welding Foundation. This is the first time in the eleven-year history of the competition that one engineering school has made a clean sweep of the three top awards.

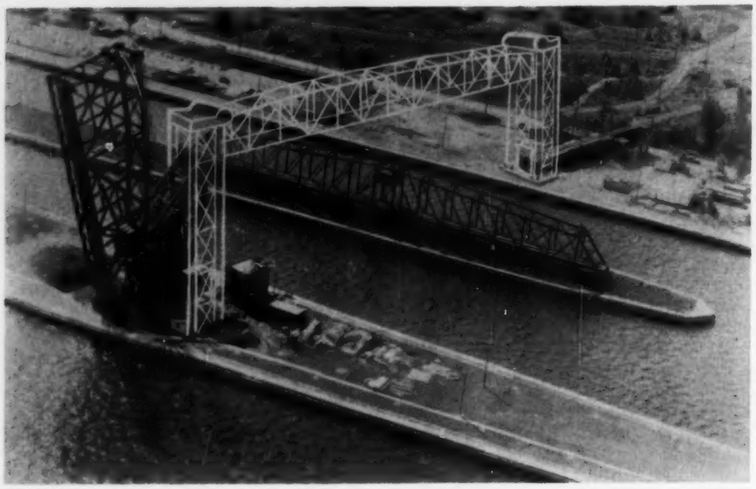
The top award of $1,250 went to Richard Jarvis, a civil engineering senior, for his design of a triangular truss footbridge using light-gage steel for the main parts. John Jenner and E. R. McLean, mechanical engineering seniors, shared the second grand prize of $1,000 for the mechanical design of an automatic welding machine. The third grand prize of $500 was divided between Gordon Kraus and Robert G. Spicher, seniors in civil engineering, for their design of a display arboretum. Four other civil engineering seniors—William P. Burke, David F. Davis, Lewis Friederick, and Harry E. Schlafman—shared one of the Sixth Awards for their design of a pedestrian footbridge.

In addition to the individual awards, the Lincoln Foundation has set up five annual scholarships of $250 each in the civil engineering department, honoring the civil engineering recipients of top awards.

U. S. Embassy Office Building to Be Built at United Nations

The only U. S. Embassy office building in the Continental United States will be this mission to the United Nations, to be built on the southeast corner of East 45th Street and United Nations Plaza, directly opposite the United Nations General Assembly Building. It will also be a close neighbor of the new United Engineering Center, for which ground will soon be broken at the corner of 47th Street and United Nations Plaza. The new structure, shown here in artist's rendering, will be the only New York City building using an overall "honeycomb" screen formed by hexagonal stone frames. The stone facade will envelop the building's inner glass wall providing natural light and sun control. Estimated cost is $3,750,000, and completion is scheduled for 1960. The project is under the direction of the Public Buildings Service, with Harwood & Gould the structural engineers and Kelly & Gruzen-Kahn and Jacobs the architects.

Lift-Span Bridge to Replace Soo Canal Swing Span



New lift-span railroad bridge, which will replace a 70-year-old swing span over the South Channel of the St. Mary's River, is being built for the Sault Ste. Marie Bridge Company. The 369-ft bridge, shown here in artist's sketch, will be erected 65 ft above the water so that the swing span can continue to operate beneath it. The two 153-ft supporting towers are progressing on schedule. Work on the span will begin in January. Completion of the $3,350,000 project is slated for August 1960. Meanwhile, daily rail traffic will be maintained, and there will be no interruption to vessel traffic entering and leaving the Soo Locks. Howard, Needles, Tammen and Bergendoff are the designers, and the American Bridge Division of U. S. Steel is the contractor.

New Jersey Starts Pier-Building Program

Robert B. Meyner, governor of New Jersey, recently drove the first pile in ceremonies marking the start of construction of the Port of New York Authority's $150,000,000 Elizabeth pier program. The vast marine terminal project includes the development of 703 acres of land south of Bound Creek along Newark Bay. It will provide berths for twenty-four vessels plus a 400-acre transit open storage area.

New Port Authority developments in the combined Newark-Elizabeth sector will represent a total investment of $275,000,000. Annual cargo capacity in the area will be increased to 11,000,000 tons.

New Nike Site in Alaska

Award of a $3,020,331 low-bid contract for construction of an additional Nike site for the Army near Ladd Air Force Base in interior Alaska is announced by the Alaska District of the Corps of Engineers. The award goes to Beck and Associates, of Seattle, a joint-venture group consisting of three firms: Beck Constructors, and Raber-Kief, both of Seattle, and McLaughlin, Inc., of Great Falls, Mont. Nine bids were submitted.

Completion date for the project, which includes five large structures, is September 30, 1959.

Thin-Shell Concrete Roof for Hunter College Library

Thin-shell concrete roof is being built for the Hunter College Library in one of the first major uses of the hyperbolic-paraboloid shape east of the Mississippi. In this view crane is easing 700-lb steel welded-wire fabric mat onto formwork. Partially showing at right is form for another inverted umbrella, with steel reinforcing in place, ready for concrete. At left forming has started for third thin-shell umbrella. Three more, 60 x 60-ft shells will be formed, completing checkerboard pattern and resulting in an overall roof 180 ft long by 60 ft wide. Architect Marcel Breuer designed the structure for the New York Board of Higher Education. General contractor is Leon D. DeMatteis & Sons, of Elmont, L. I. Jerry Furst is project engineer for the Board of Education.

Iron and Steel Companies Expand Facilities in 1958

A wide variety of capital improvement programs was carried out by the iron and steel companies in 1958, according to the American Iron and Steel Institute. The principal programs—started, finished, or in progress this year—centered on the construction of some twenty rolling mills of various types and sizes. The year also set a record for the construction of new sintering plants, which help boost blast furnace production and reduce operating costs. Over 20,000,000 tons of sintering capacity has been added.

The improvement program also includes new, continuous annealing lines for speedy annealing of steel strip without a halt; new steelmaking furnaces—mostly electric units; coke oven batteries; a new battery of soaking pits; new research centers; pilot mills and pilot plants; and completion and operation of all the facilities of a new $300,000,000 taconite project in Minnesota.

The industry's capital improvement program helped combat the recession in furnace, mill and commodities, and in plants making machinery, construction materials, and other equipment, according to the Institute.

Capacity for producing structural steel has been increased 60 percent since 1950, according to Bethlehem Steel Company spokesmen. They believe that the capacity now available is adequate to meet all the needs for the immediate future. With the plants for producing structural shapes operating far under capacity steel is quickly available in all ranges of sizes.

ASHAE-ASRE Merger Voted by Members

Merger of the American Society of Heating and Air Conditioning Engineers and the American Society of Refrigerating Engineers has been approved by a vote of the two societies. A joint announcement was made by the two groups on December 2, following the completion of balloting at a special meeting of the ASHAE in Chicago and at the ASRE's semiannual meeting in New Orleans. Each group recorded a high number of ballots, with 93 percent of the ASHAE and 73 percent of the ASRE voting for the merger.

The consolidated society will be called the American Society of Heating, Refrigerating and Air Conditioning Engineers. Both organizations have their headquarters in New York City.

Overhaul and Test Buildings For Pan American Airways

Burns and Roe, Inc., New York engineers and constructors, have been engaged by Pan American World Airways to design, engineer, and supervise construction of jet engine overhaul and test facilities at New York International Airport. The overhaul building, which will be 330 ft long by 160 ft wide, will include welding, machine plating, assembly and disassembly shops, and office facilities. It will feature steel and curtain wall construction. The test facility will be a basic concrete structure consisting initially of a single test cell.

Steel Shipments Up

Shipments of finished steel products during October totaled 6,224,540 net tons—nearly 16 percent more than in September, and the highest since October a year ago, according to the American Iron and Steel Institute. In the first ten months of the year shipments totaled 49,226,073 net tons in comparison with 69,155,531 net tons during the same months of 1957.

Major markets for finished steel products this October were, in this order, warehouses and distributors; the automotive industry; containers; and the construction industry.

N. G. Neare's COLUMN

R. ROBINSON ROWE, M.ASCE

"Magic cubes!" scoffed Joe Kerr. "I could have set up the same problem in the kitchen sink."

"Please, Joe," begged Professor Neare, "Remember this was the problem of our Guest Professor. Let's not hurt his feelings, shall we?"

"Maybe Joe's a topologist," smiled Professor Pewter. "The pattern of the problem was

6
0 0 0 0
0 0 0
0 0 0 0
0

which does suggest the holes in a sink strainer, but I used the cubes to designate six groups of four circles which would each add to 27 if marked with the first 13 digits. I like cubes, but if Joe can work better with sink holes. . . ."

"Well, let me explain with my diagram," interrupted Joe. "It's

6
A K L E
J I M
B O N D
C

which gave me the relations:

$$
\begin{aligned}
27 &= 6 + K + L + I \\
&= A + J + K + I \\
&= B + J + O + I \\
&= C + N + O + I \\
&= D + M + N + I \\
&= E + L + M + I \\
A + B + C + D + E - 41 &= 14 \\
J + K + L + M + N + O + 51 &= 71
\end{aligned}
$$

or 8 equations in 12 unknowns. That's why I said I could set the problem up in the kitchen sink, but I still can't solve it."

"I've always said Joe was lazy," sneered Cal Klater. "He has enuf equations for a cut-and-try solution, but he didn't try. Of course if he blindly tries each combination of 12 integers, the 12! combinations would take him a life time, but there are a lot of short cuts. His last equation limits I to the range 2—9. For his first, there are only 13 combinations of three available integers adding to 21. In short order he would have

6
8 4 12 3
10 5 7
1 11 2 13
9

"That's right," agreed the Guest Professor. "Not counting reflections and rotations, there are eight basic solutions to the problem of the magic cubes, only one of which has a 6 on a vertex."

"I'll take your word for it," added Professor Neare. "I understand you worked out all the possibilities while convalescing in a hospital with lots of time on your hands. Now, Kum, couldn't you give us a sequel that Joe could try out on his sink strainer and try to prove he isn't lazy all the time?"

"Gladly, and I had an encore ready just in case. If you look at the pattern of 13 holes, you can count 6 rows of 4 holes. Let Joe keep the figure in the top vertex and make the 6 rows each add to 27, using the same integers 1 to 13. Then let Cal do the same problem upside down."

[*Cal Klaters were Emerson Boyd Jr., Thatchrite (Guy C. Thatcher), and O'Kay (Otto H. S. Koch). Also acknowledged is a solution of the October problem from David V. Messman. Guest Professor Kum Pewter is Walter Steinbruch).*]

DECEASED

Charles W. Allen (A.M. '38), age 53, chief research engineer for the Ohio Department of Highways, Columbus, died on October 10. He had been with the department since 1933. He attended Ohio State University where he received his bachelor of civil engineering degree in 1929 and his professional civil engineering degree in 1938. Mr. Allen was past president of the Central Ohio Section of ASCE; Ohio representative on the Advisory Committee of Highway Research Board Correlation Service; and chairman of the HRB Committee on Air-Entrained Concrete. He had published several papers on highway pavement materials.

Arthur F. Barnes (A.M. '28), age 59, office engineer for R. B. Potashnick Construction, Cape Girardeau, Mo., died in Missouri recently. Mr. Barnes earned his civil engineering degree at the University of Missouri and for many years was employed as a resident engineer in the St. Louis Water Department. He had also been construction engineer and designer for John Griffiths & Son, Chicago, Ill.; construction engineer and superintendent for G. L. Tarlton, St. Louis, Mo.; and assistant superintendent for Frazier-Davis Construction Company, Chicago, Ill. In the 1940's Mr. Barnes served as a Lieutenant Colonel in the Corps of Engineers of the U. S. Army.

Herman C. Berry (M. '20), age 84, retired professor of materials of construction at the University of Pennsylvania, died on June 11. He was a resident of Moylan, Pa. Mr. Berry, a graduate of Purdue University with a degree in civil engineering, developed strain measuring apparatus for concrete. A specialist in materials testing, he spent his entire career on the University of Pennsylvania faculty.

G. Gale Dixon (M. '17), age 73, an associate and chief sanitary engineer in the New York firm of Parsons, Brinckerhoff, Hall & Macdonald for the past seventeen years, died in New York on December 6. Mr. Dixon served on the Board of Review appointed by Secretary Ickes to advise on plans for the West-Southwest Sewage Treatment Works for Chicago, Ill., one of the seven civil engineering wonders of the modern world. During his long career he designed water and sewage works for such cities as New York, St. Louis, Houston, Philadelphia, and Akron. Mr. Dixon was a graduate of the College of the City of New York.

G. Gale Dixon

H. C. Gallimore (M. '50), age 72, of Cleveland, Ohio, died in New York on October 20. In 1908, Mr. Gallimore joined the F. A. Pease Engineering Company as a tracer and over the years became an officer, partner and, on the death of F. A. Pease in 1955, sole owner of the engineering company. He and his firm had been municipal engineers for many suburban governments in the Cleveland area. Much of Shaker Heights' expansion some years ago was planned by Mr. Gallimore and the F. A. Pease Company in association with the Van Sweringen Company. Mr. Gallimore was graduated from Ohio Wesleyan University.

H. C. Gallimore

David W. Hays (A.M. '10), age 80, former general manager of the Canada Land and Irrigation Company, of Canada, died in Medicine Hat, Canada, on September 12. For the past few years, he had been in private practice as a consulting engineer in Medicine Hat. Mr. Hays early in his engineering career served as chief engineer with the Southern Alberta Land Company of Canada.

J. Norman Heil (M. '52), age 60, highway engineer for the U.S. Bureau of Public Roads, at Kansas City, Mo., died there recently. Mr. Heil, who had been with the Bureau for over twenty years, also served as Bureau manager in North Dakota and Minnesota. Prior to joining the Bureau, he was with the Easton, Pa., Bureau of Waterworks and Sewerage and the Joint Commission for the Elimination of Toll Bridges over the Delaware River. At one time he was with the U. S. Coast and Geodetic Survey at Easton.

W. H. Holmes (A.M. '24), age 63, consulting engineer of Sacramento, Calif., died there recently. A graduate of Leland Stanford Jr. University, Mr. Holmes had been employed by the California Department of Public Works for fifteen years as senior engineer and more recently as hydraulic engineer. Previously he was chief engineer for the Modesto Irrigation District in California.

Theodore Horton (M. '05), age 88, retired chief sanitary engineer of the New York State Department of Health, died at Sandwich, Mass., on December 7. Mr. Horton when he joined the Department in 1906 to head the newly established Sanitary Engineering Division had already received recognition for his methods of solving water supply and sewerage problems. He was especially known for his "Mass Diagrams" which were successfully employed in studies for an additional water supply for New York

(Continued on page 96)

Deceased

(Continued from page 94)

City at the turn of the century. Mr. Horton, a graduate of Massachusetts Institute of Technology, was principal author of a textbook in his field, which was used for many years at the Institute.

Carl G. Levander (M. '43), age 60, partner in the consulting firm, Montgomery, Williams, and Levander, of Austin, Tex., was killed in a recent automobile accident. Most of his career had been spent serving the City of Austin, as superintendent of the Sewer Department, assistant city engineer, and more recently as director of public works. Mr. Levander was a graduate of Valparaiso University in Indiana.

James A. Lewis (A.M. '22), age 68, a partner in the firm of Miller, Martin, and Lewis, of Birmingham, Ala., recently died. He was chief engineer for many years with Miller, Martin Architects prior to 1941 when he became a partner in the firm. Mr. Lewis, a specialist in the field of reinforced concrete and structural steel buildings, was engineer in charge of an extensive Federal Housing Project, which involved the construction of seventy apartment buildings. His firm's projects also included fifteen buildings for the University of Alabama.

Thomas G. MacCarthy (M. '29), age 65, senior civil engineer, Corps of Engineers, at Los Angeles, Calif., died there recently. Immediately after receiving his B.S. in Civil Engineering from Columbia University in 1917, Mr. MacCarthy joined the Marine Corps as a private rising to the rank of captain. For several years he was associate professor of highway engineering at the Missouri School of Mines, and, later, professor and head of the civil engineering department at Southern Methodist University. Since World War II, he had served as assistant, associate, and senior engineer with the Corps. A past president of the Society's Texas Section, Mr. MacCarthy served on the International Boundary Commission, American Section, 1934-1937, and the State Commission on Engineering Education, 1937.

Andrew J. A. Meehan (M. '38), age 63, supervising bridge engineer for the Division of Highways of the California Department of Public Works at Sacramento, died recently in Alaska. Mr. Meehan had been with the Department of Public Works for many years, during which time he was senior engineer on the design and construction of the San Francisco-Oakland Bay Bridge. Mr. Meehan had been a vice president of the Sacramento Section of ASCE and served as chairman on several of its committees. He had also contributed papers to various technical publications. He was educated at the Mechanics Institute, Rochester, N. Y.

Grover C. Morriss (M. '53), age 76, consulting engineer of Temple, Tex., died on November 2. A graduate of Burleson College, Texas, he specialized in photogrammetry, in which capacity he served the General Land Office at Austin, for more than fifteen years. Prior to entering private practice at Temple, he had been director of the Land Office. Mr. Morriss wrote numerous papers on photogrammetric mapping.

J. Edward Powell (A.M. '32), age 54, structural designing engineer for the Anaconda Copper Mining Company of New York City, died there on November 5. He was graduated from Rensselaer Polytechnic Institute and New York University. For some years he was associated with the Hardesty and Hanover consulting engineering firm of New York. Mr. Powell had been a lecturer at Manhattan College and Brooklyn Polytechnic Institute.

John Charles Rathbun (M. '21), age 76, professor emeritus of civil engineering at the City College of New York, died in New York on November 12. Professor Rathbun, a member of the faculty of the City College for eighteen years until his retirement in 1949, had previously taught at Antioch College and at the University of Washington, and had been head of the department of civil engineering at the South Dakota School of Mines. Professor Rathbun was the originator and developer of the "elastic skew arch theory" used in overhead construction. In the course of his long and active career he was designing engineer for the City Water Department in Tacoma, Wash.; superintendent of bridge construction for the City of Seattle; and assistant principal of Tung Wen Institute in Amoy, China. His stay in Amoy served as the background for a report he subsequently prepared for the War Department on "Amoy, China, from a Military Standpoint." Professor Rathbun was a graduate of the University of Washington and a Ph.D. graduate in civil engineering of Columbia University.

J. C. Rathbun

Camille C. Rossi (A.M. '21), age 71, internationally famous structural engineer of San Mateo, Calif., died there on October 15. Mr. Rossi gained wide prominence as builder of one of the world's largest dams, the La Bouquilla in Mexico, and as structural engineer for William Randolph Hearst's multi-million dollar castle at San Simeon, a project which took ten years to build. At the age of nineteen, Mr. Rossi went to Mexico City, where he participated in the

(Continued on page 99)

. . . and now *Duralar**
joins this famous family of fine pencils

*The only pencil specifically designed for work on matte-surface tracing film of Mylar®, DURALAR is the newest in the complete line of fine MARS drafting products. All are imported from West Germany and made to meet the highest professional standards. Below ● Bright-hued LUMOCHROM pencils in 24 colors for color-coded drafting and perfect reproduction ● LUMOGRAPH graphite drawing pencils in 19 degrees; some degrees available with erasers, some with special chisel points ● TECHNICO lead holders for color and black graphite drawing, with new sure-hold finger grips and degree markings for quick identification; also with clips, for pocket use ● NON-PRINT pencil and leads make notes and sketches that will not reproduce ● Pencil sharpeners in STANDARD and "DRAFTSMAN" models; latter with adjustable point-length feature. ®T.M. FOR duPONT'S POLYESTER FILM

MARS

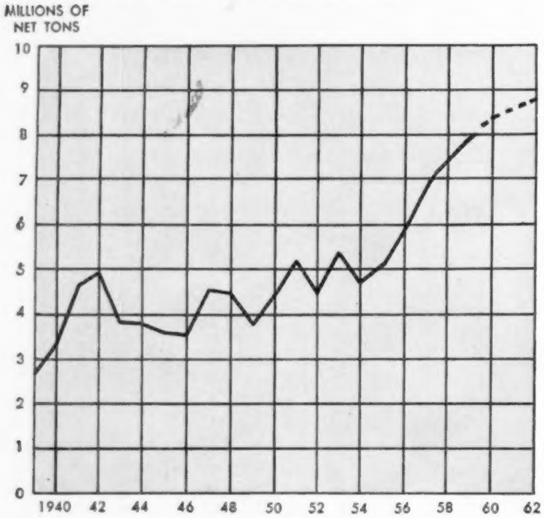
J. S. STAEDTLER, INC.

HACKENSACK, NEW JERSEY

MORE structural steel is available-now and in the years to come

In 1959 builders of highways, bridges and buildings will have available more steel than ever before. The steel industry (and Bethlehem Steel in particular) has expanded facilities for producing structural shapes so that there *is* steel for the job.

RISE IN STEEL INDUSTRY'S PRODUCTION OF HEAVY STRUCTURAL SHAPES



We estimate the industry will be able to turn out 8 million tons of structural steel in 1959. What's more, it is estimated that anticipated expansion will bring the industry's capacity up to 9 million tons annually by the mid 1960's.

BETHLEHEM INCREASES CAPACITY

Since our Bethlehem, Pa., plant is the largest single unit producing structural shapes in the country, its role is a most important one.

In 1955, for example, we were caught in a squeeze. We had foreseen the increased demand and had already started a huge expansion program a year earlier. Expansion on such a major scale required the shutting down of some facilities, and just at that critical period, the boom hit. So while we were in the midst of trying to relieve the shortage of the future, we were temporarily unable to turn out as much as before.

But it all paid off. Today Bethlehem is able to turn out over 3 million tons of shapes each year, or about 40 per cent of the entire industry's total.

Structural steel *is* available. You can plan and design in structural steel with complete assurance, both now and in the years to come.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation*

BETHLEHEM STEEL

Deceased

(Continued from page 96)

erection of Piatro Nacionale, famed later as the sinking opera house. Mr. Rossi, at the time, told engineers that the building was beginning to sink, but because of his youth he was not believed.

F. R. Sweeny (M. '21), age 73, of the firm of F. R. Sweeny & Company, Anderson, S. C., died there on October 30. Shortly after his graduation from Clemson College, in South Carolina, he returned there as associate professor of civil engineering. He then attended Rensselaer Polytechnic Institute where he received a civil engineering degree. After graduation he joined the Foundation Company, becoming assistant chief engineer of their Pittsburgh branch. During this period, Mr. Sweeny worked on the design of cofferdams, and his treatment of cofferdam design has since become standard in textbooks. He had also served as chief engineer of the South Carolina Public Authority in charge of the Santee-Cooper Hydroelectric Development.

Charles L. Spaulding (M. '08), age 91, retired construction engineer with the New York Central Railroad Hudson and Harlem Divisions, died in New York on November 15. A railroad man most of his life, Mr. Spaulding joined the New York Central and Hudson River Railroad Company in 1903, and became engineer in charge of construction at Schenectady and Yonkers and general construction on the Hudson and Harlem Divisions. After retiring from the New York Central in 1937, he served for ten years as chief engineer for the Elmhurst, L. I., Contracting Company. Mr. Spaulding had been engineer and secretary of the Yonkers Waterfront Commission.

Robert P. Woods (M. '03), age 88, recently retired street railway commissioner for Kansas City, Mo., died there recently. Mr. Woods, who had held the position of commissioner for twenty years at the time of his retirement in 1958, was a former member of the Board of Directors of the Kansas City Public Service and a member for years of the City Planning Commission. Early in his career he was chief engineer on the construction of various traction lines throughout Indiana, and engineered the building of the old Kansas City Clay County & St. Joseph Railway Company which he later served as operating and managing executive. Mr. Woods, in 1900, received the ASCE Collingwood Prize for a paper on street grade and cross-sections in asphalt and cement.

Robert P. Woods

RECENT BOOKS

(added to the Engineering Societies Library)

ASTM Standards in Building Codes

A compilation of those standards that have been adopted in some form by the various building codes throughout the United States and Canada. The standards relate primarily to the materials used in building construction. (Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., 1958. 1041 pp., paper. $8.00.)

The Analysis of Grid Frameworks and Related Structures

Presents a practical method of calculating the distribution of bending moments, deflections, etc., in a variety of structures such as bridge decks, interconnected beams, cantilevers, and arches. The first part deals with commonly occurring structures which can be analyzed by means of plotted coefficients, while the second is an analytical section containing the derivation of these coefficients and the application of the method to more complicated problems which cannot be solved in general terms. A concluding section describes experimental work on model and large scale structures, which provides confirmation of the accuracy of the methods described. (By Arnold W. Hendry and Leslie G. Jaeger. Chatto and Windus, Ltd., London, England, 1958. 308 pp., bound. 50s.)

Civil Engineering Construction

Primarily concerned with construction problems rather than design. The section on plant covers such equipment as excavation and earthmoving, deep-drilling, tunnel work, blasting, hoisting and conveying, pumping and dewatering, pile driving, driving and air-lock equipment, and concreting. This is followed by a section on construction methods that deals with open excavations, shafts and tunnels, foundations, cofferdams and caissons, timber and concrete construction, steel structures, bridges, roads, and river works. The concluding section deals with planning and organization of the project. (By James M. Antill and Paul W. S. Ryan. Angus and Robertson, London, England, 1957. 626 pp., bound. 75s.)

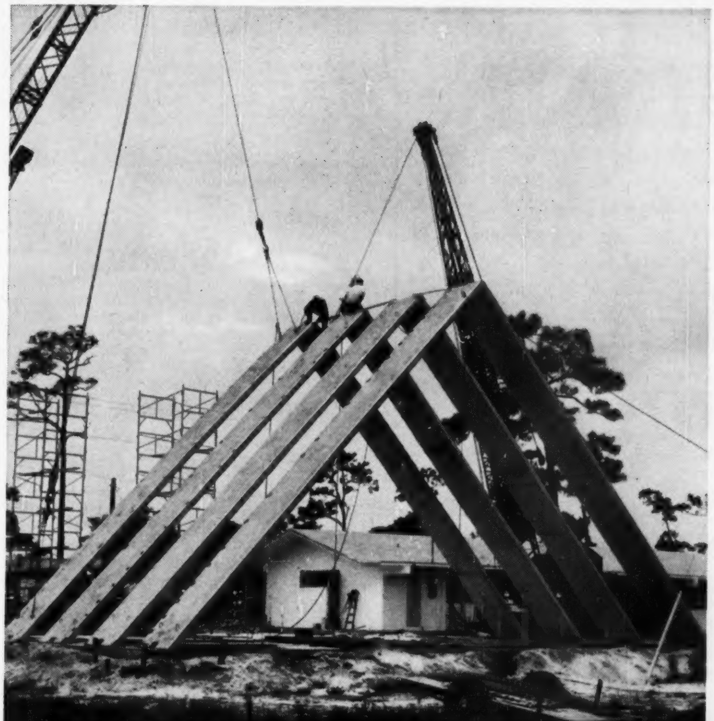
Coastal Engineering; Proceedings of the Sixth Conference, 1957

Papers dealing with wind, waves, and wind tides, with considerable emphasis on the hurricane; coastal sediment problems; coastal engineering problems; coastal structures and related problems, including breakwaters, wave absorbers, and sea walls. The theoretical aspects of the subject are covered as are specific problems in various localities. (Published by The Council on Wave Research, Engineering Foundation, University of California, Richmond, Calif., 1958. 896 pp., paper.)

Elementary Seismology

The first part of the book deals with the physical basis of earthquakes and covers such areas as the nature of earthquake motion; effects on construction and on ground and surface water; intensity and isothermals; types of earthquakes; seismograph theory and practice; elastic waves and seismic waves; magnitude, statistics, and energy. The concluding portion deals

(Continued on page 102)



Working together, two cranes position prestressed slabs. 20 slabs are 5½" thick, 4' wide and 38½' long; 8 slabs are 4" x 4' x 38½'; there are 10 shorter slabs 4" x 4' x 30'

- The St. Ambrose Episcopal Church in West Fort Lauderdale, Fla. is another example of the almost unlimited possibilities of modern precast, prestressed concrete construction.

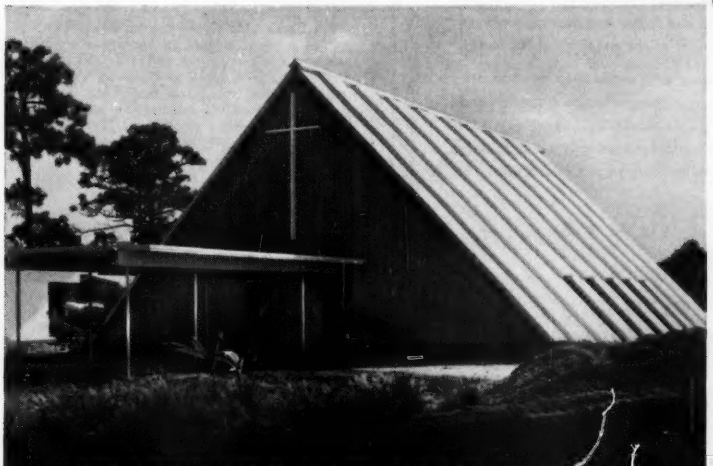
Just 38 prestressed slabs were required for this unique structure. Cast with plates imbedded at the ends and along the sides, slabs were fitted into slots in the footings, hoisted into place and welded together. The joints were coated with roofing material. That's all there was to it.

By eliminating conventional walls and roof, this technique resulted in substantial savings to the owner. The appearance of the completed job speaks for itself.

The prestressed slabs were made with Lehigh Early Strength Cement at the R. H. Wright & Son, Deerfield plant. Its use helps them save time and money in producing a variety of top quality concrete units.

On the interior, prestressed slabs were sprayed with an acoustical plaster.

NEW CHURCH DESIGN SHOWS VERSATILITY OF **PRECAST, PRESTRESSED CONCRETE**



Ample daylight flows into the church through the 5 open spaces on each side

ARCHITECT: Johnson and McAlpine, Ft. Lauderdale, Fla.
CONTRACTOR: Quick Quality Construction, Inc., Ft. Lauderdale, Fla.
PRECAST, PRESTRESSED CONCRETE UNITS MANUFACTURED BY: R. H. Wright & Son, Ft. Lauderdale, Fla.

- LEHIGH EARLY STRENGTH CEMENT
- LEHIGH PORTLAND CEMENT
- LEHIGH AIR-ENTRAINING CEMENT
- LEHIGH MORTAR CEMENT

LEHIGH PORTLAND CEMENT COMPANY
Allentown, Pa.

Recent Books

(Continued from page 100)

with earthquakes in relation to geographical locations. (By Charless F. Richter. W. H. Freeman and Company, 660 Market Street, San Francisco 4, Calif., 1958. 768 pp., bound. $12.00.)

Engineering Drawing

Second Edition

A text covering the fundamentals of engineering drawing, descriptive geometry, and graphical analysis. This revised edition contains new chapters on structural drawing, charts and graphs, electrical drafting, and descriptive geometry, while new material has been added to the sections on freehand drafting, geometrical constructions, dimensioning, and cams and gears. (By Frank Zozzora. McGraw-Hill Book Company, 330 West 42nd Street, New York 36, N. Y., 1958. 440 pp., bound. $6.50.)

Modern Materials: Advances in Development and Applications

Volume 1

This volume, which is the first in a series, covers a variety of materials and the recent developments in connection with them: zirconium; the semiconductors, germanium and silicon; ceramic engineering materials and their applications; insulating papers for high voltages; glasses required to withstand strong irradiation in nuclear engineering; synthetic rubbers for special purposes; new areas of wood as a structural material; organic and inorganic fibers. (Edited by Henry H. Hausner. Academic Press, Inc., 111 Fifth Avenue, New York 3, N.Y., 1958. 402 pp., bound. $12.50.)

Procedures for Testing Soils

Brings together all of the ASTM standards on the engineering properties of soil. Included are standards on soil explorations and sampling of soils; physical characteristics, physico-chemical properties, and identification of soils; physical and structural properties of soils; special and construction control tests; soil bearing tests, dynamic properties of soils, and load tests on piles. (Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1958. 544 pp., paper. $6.75.)

Theorie und Berechnung der Stahlbrucken

In dealing with the theory and design of steel bridges the author first discusses the fundamentals of elasticity and plasticity. He then develops the theory of plates and of girder grillages, and reviews the stability problem with special attention to buckling. The rest of the book is devoted to modern design methods for highway bridges, solid-web girder bridges, lattice girder bridges, arch bridges, suspension bridges, and compound bridges. The book is intended for the structural engineer as well as for the student. (By Alfred Hawranek. Fourth Edition revised by Otto Steinhardt. Springer-Verlag, Berlin, Germany, 1958. 426 pp., bound. DM 66.)

Teaching Aids and Allied Materials in Engineering Geology

Textbooks widely used in courses are tabulated, as are colleges offering a major in engineering geology, films appropriate for teaching courses, and field and laboratory exercises. A suggested undergraduate course of study for engineering geology is given. (Published by the Geological Society of America, 419 West 117th Street, New York 27, N.Y., 1957. 35 pp., paper. $.75.)

U.S. Research Reactor Operation and Use

Studies the research reactor as a means of providing a strong source of neutrons and gamma rays for physical research, irradiation testing, and producing radioactive isotopes. The principal emphasis in the book is on the advantages and disadvantages of different reactors and on the costs of acquiring and operating a research reactor facility. Each type of research reactor is described in detail and analyzed in relation to specific needs. A volume in the Atoms for Peace presentation set. (Edited by Joel W. Chastain, Jr. Addison-Wesley Publishing Co., Inc., Reading, Mass., 1958. 366 pp., bound. $7.50.)

(Continued on page 106)

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

NEW YORK | CHICAGO | SAN FRANCISCO
8 W. 40th ST. | 84 E. RANDOLPH ST. | 57 POST ST.

These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which cooperates with the national societies of Civil, Electrical, Mechanical, Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or non-members, and is operated on a non-profit basis. If you are interested in any of these listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee of 5 percent of the first year's salary if a non-member, or 4 percent if a member. Also, that you will agree to sign our placement fee agreement which will be mailed to you immediately, by our office, after receiving your application. In sending applications be sure to list the key and job number.

When making application for a position include 8 cents in stamps for forwarding application to the employer and for returning when possible.

A weekly bulletin of engineering positions open is available at a subscription rate of $3.50 per quarter or $12 per annum for members, $4.50 per quarter or $14 per annum for non-members, payable in advance.

Men Available

Plant Engineer/Structural Engineer, A.M. ASCE, B. Business Administration, B. Structural Engineering; 40; registered P.E. in Ohio. Eleven years' structural engineering experience including nine years' steam power plants, industrial buildings, warehouses and plant engineering; two years' customer service in sales department; concrete, steel, foundations, equipment supports, specifications. Desires position in plant engineering, structural design or as purchasing agent. Will relocate. C-410.

Civil Engineer, M. ASCE, D.Sc. (Engineering) from a German University, M.A.S.C.E., A.M.-I.C.E., 49. Long experience in hydrology, river training, irrigation and drainage, management of watersheds, engineering surveying and investigations. Citizen of British Commonwealth, presently employed Far East in executive post, desires position anywhere in U.S. C-411.

Civil Engineer, M. ASCE, C.E., N.Y. and Vermont registration. Fifteen years' municipal utilities. Eight years' chemical industry. Design and administrative experience. Strong Sanitary Engineering. Experience ideal for consultant or contract engineering firm. Management calibre. Preferred location: East, either Pennsylvania or upstate New York. C-412.

Field Engineer, Civil, J.M. ASCE, 29. Five years' heavy construction including three years of modern highway plus five years' land surveying title and construction surveys in New York. P.E. and L.S. licenses. Location desired: Long Island area. C-413.

Structural Engineer, J.M. ASCE, B.S.C.E., 31. Four years of design of industrial buildings; (steel and concrete) design of heavy foundations, deep foundations, tunnels. Good background in soil mechanics. Three years of field experience on highways and small commercial buildings. Supervisory experience; writing of specifications. Location desired: Vicinity of New York City. C-414.

Professor, A.M. ASCE, Master's degree, 36. Sixteen years of structural and foundation design engineering experience, including six years of teaching. Presently, consulting engineer and teaching part-time. Desires teaching position. Location preferred: East Coast. C-415.

Civil Engineer, A.M. ASCE, B.S.C.E., 30, registered professionally in New York, Wisconsin, Louisiana. Construction superintendent (last project budgeted at 30 million dollars), pilot's license. Has held positions as resident engineer, director of public works. Desires position with opportunity in management or administration, permanent location. Prefers overseas or Northeast, Midwest or Western United States. C-146-307. San Francisco.

Sales Engineer or Technical Representative, J.M. ASCE, B.S.C.E., 31. Three years' responsible structural design of steel and concrete industrial structures: three years' heavy industrial construction field supervision, both structural and mechanical. Desires opportunity as sales engineer with future management possibilities. Location desired: U.S.—Midwest preferred C-417-920. Chicago.

Positions Available

Teaching Personnel in engineering, mathematics, physics and chemistry. Program of development includes strengthening faculty, inaugurating a graduate program and designing a new science and engineering building. Location, Middle East. F-6237.

Senior Sanitary Engineer, P.E. license desirable but not necessary. Must be capable of handling design of sewerage systems and treatment plants and have knowledge of water systems. Must have ability to handle men as this position will shortly lead to supervisory position. Salary, $7800-$8320 a year. Opportunity for overtime and fringe benefits. Company will pay placement fee. Location, Connecticut. W-6613.

Associate Professor or Professor, Doctorate required, for research and teaching in structures. Salary, $8,400-$9,600 a year. Location, South. W-6616.

Public Health Engineer or Sanitary Engineer, or other related academic background and experience; advanced degree desirable. Responsibilities will include coordination of existing programs in sanitation, waste handling, inspection procedures, etc. and organization and planning of future programs. Also, some instruction in proper sanitation practices to employees and students. Location, Pennsylvania. W-6630.

Sales Engineer, Sanitary, to sell industrial and municipal waste disposal equipment, preferably a Master's degree in sanitary engineering and work experience on a State Board of Health, in industry applying sanitary engineering background or in municipal work. Will consider recent graduate sanitary engineer with sales potential. Salary open depending upon experience and educational background. Location, Philadelphia, Pennsylvania. W-6641.

Chief Engineer, B.S. in C.E., with experience in irrigation systems, construction, piping and road and bridge building. A minimum of five years experience as resident engineer or engineer in charge of such projects. Must also have executive ability in civil engineering positions in the past. Salary, $10,000-$12,000 a year. Location, Honduras. F-6677.

Junior Engineers. (*a*) Civil graduate, preferably single. Should have three to four years experience covering at least two or three of the following areas: Survey and topographical mapping, structural design and construction, hydraulic engineering, irrigation and drainage, and pump installation. Salary, $6,000-$7,200 a year. (b) Recent civil graduate, preferably single, for work as outlined above. Salary, $4,800-$5,400 a year. Location, Honduras. F-6678.

Teaching Personnel. (*a*) Assistant professor in civil engineering, to teach theory of structures, materials of construction, and steel and timber structures. (*b*) Assistant professor in civil engineering, to teach soil mechanics, foundations and reinforced concrete. Salaries, $4800-$6000 a year. (*c*) Professor of civil or mechanical engineering to teach third and fourth year engineering and to serve as Dean of College. Salary, $7200-$8400 a year. Transportation will be paid for applicant and wife. All salaries are tax exempt. Locations, Foreign. F-6683.

Director of Engineering and Construction, graduate, for a large food and beverage company. Will take complete charge of actual construction on new plant, as well as engineering and maintenance when in operation. Salary, $25,000-$30,000 a year. Location, Midwest. W-6700.

Field Office and Cost Engineer for construction company specializing in industrial buildings. Must have knowledge of costs and estimates in general construction and be willing to reside where jobs are located. Two openings at present; one in northern New Jersey, the other in Cincinnati, Ohio. Salary, $8400-$9600 a year. W-6701.

Sales Engineer with engineering training and asphalt highway experience, for sales promotion and application work covering asphalt sealing compounds. Considerable traveling in U.S.A. except Pacific Coast. Salary, $7500 a year plus bonus. Headquarters, New York, N.Y. W-6702.

Project Engineer, graduate civil, to take complete charge of preliminary sewerage surveys for large municipality in South America. Would prepare master plan for all sanitary facilities. Knowledge of Spanish desirable. Salary open. One year to 18 months work. Location, South America. F-6722.

Structural Engineer, Master's or Ph.D. degree, with considerable experience, for a prominent consulting engineering firm. Location, Midwest. W-6726.

Trainees, graduate mechanical or civil, for multi-plant operation for the manufacture of cement, lime, refractory and related products. Salary, about $6000 a year. Location, Midwest. W-6729.

Senior Instructor, civil graduate, with at least five years experience teaching surveying and preferably some field engineering covering land and aerial surveys. Salary, $12,000-$15,000 a year. Location, Middle East. F-6741.

Teaching Personnel for Department of Civil Engineering, Ph.D. degree required, however, this might be waived for men with well established position in his field. (*a*) One for engineering mechanics, (*b*) One for structural analysis or design in addition to supervising structural tests.

ESPS

Salaries open, depending upon applicants' qualifications. Location, East. W-6751.

SURVEY ENGINEER, professional degree; desirable to be registered; with five years professional experience in this field. Thorough knowledge of economically practical construction methods. Experience in preparing technical studies, criteria and standards. Salary, $9000 a year, plus $150 a month. Living allowance; transportation provided for applicant and dependents; medical, dental, PX and commissary privileges provided. Location, Mediterranean area. F-6752.

SURVEYOR, licensed, to handle surveys and subdivision work. Salary open. Location, vicinity of Niagara Falls, New York. W-6763.

GENERAL CONSTRUCTION BUILDING SUPERINTENDENT, with considerable experience in general building construction. Must be able to coordinate the field operations of 15 to 20 field superintendents, and be capable of working under pressure to deadline dates. Salary, $15,000 a year, minimum. Headquarters, New York, N.Y. W-6793.

ESTIMATOR, experienced in concrete structures, grouting, foundations and concrete design. Outstanding opportunity with nationwide contractor. Location, Ohio. W-6794.

STRUCTURAL ENGINEER, Graduate Civil, with some experience, to do design and detailing on industrial buildings, bridge and grade separation work and general highway facilities. Will also include quantity and cost estimates and other related work. Some travel. Salary open. Location, Louisiana. W-6798.

STRUCTURES ENGINEERS, Aircraft, with five to ten years experience. (1) Pre-design and analysis of basic airframes. (2) Responsible for structural design loads. (3) Design criteria for preliminary design and/or project design. Salaries, $9,000-$12,000 a year. Location, New York State. W-6815.

SALES ENGINEER, Steel Products, preferably C.E., structural or mechanical, no degree required, but college training necessary. Minimum of three years direct sales experience in construction or metal products. Work involves design, estimates, working with blueprints; deal with agencies of Federal Government and with prison boards. Travel in State of California and occasionally in adjoining states. Salary, $7,200-$9,000 a year, plus car. S-3955.

OFFICE ENGINEER, Industrial Subdivisions, C.E., familiar with and able to do land computation, survey checking, preparation and checking land maps and drawings. Search records, contact city and county record offices, work for senior land engineer in industrial subdivision enterprises. Salary, $6,600 a year. Location, San Francisco East Bay. S-3401.

CIVIL ENGINEER, Public Works, graduate civil or equivalent, minimum of eight years responsible experience in civil engineering, at least four years of such experience on managerial or supervisory level in commercial firm or government facility, know design, construction, of bridges, roads, area and structural utilization, POL and ammunition facilities, utility systems and housing development, familiar with programming and scheduling. To advise and assist planning, design, construction and maintenance of bridges, roads, airstrips, parade grounds, utility systems, drainage and sanitary facilities. Act as technical consultant. Salary, $10,200-$12,000 a year. Location, Korea. S-3966R.

STRUCTURAL DESIGNER, Aqueduct, C.E., minimum of two years experience related to installation of 87 inch pipe, valving and related mechanical equipment for underground (trench or tunnel) or on trestles. For water utility. Salary, $6,720 a year. Location, San Francisco East Bay. S-3977.

FIELD ENGINEER, Highway Construction, C.E., military completed, two to three years on work related to highway construction (field, office, checking, inspecting, locating, cost, some estimating). Must be aggressive. Will consider recent graduates with substantial courses in highway construction. Salary, $6,000 a year and up, depending on experience. For general contractor. Must be willing to move from job to job. Headquarters, San Francisco. S-3995.

Applications for Admission to ASCE, Nov. 1-Nov. 29, 1958

Applying for Member

HANS JOHANNES ARUS, Toronto, Ont., Canada
HOWARD JOHN BARBONS, Lansing, Mich.
AUSTIN BUERCKLIN, Little Rock, Ark.
STANLEY WALTER DZIUBAN, Waltham, Mass.
CHARLES WYATT EUBANK, Omaha, Nebr.
IRVING GOOZMAN, New York, N. Y.
JOHN PAUL HARDING, Los Angeles, Calif.
ROSS GOETZ HENRY, Helena, Mont.
ROBERT LOUIS KLAUSMEIER, Wilmington, Del.
ROY EMANUEL LUNDQUIST, Cincinnati, Ohio
ROBERT WARDLAW MOORMAN, Clemson, S. C.
RICHARD EUGENE MORRIS, Chicago, Ill.
JOHN D. O'CONNOR, Mobile, Ala.
WILLIAM LEROY PERRY, Houston, Tex.
OTTO PFAFSTETTER, Rio de Janerio, Brazil
LAWRENCE FULLER PRATT, North Hollywood, Calif.
JOHN REINHOLD VON RENTELN, Watertown, N. Y.
GUY RAOUL RINFRET, Montreal, Quebec
PERCIVAL CHARLES ROBERTS, Harrisburg, Pa.
CESAR JUAN SERVICI, Buenos Aires, Argentina
EDWIN JOHN SHIELDS, St. Louis, Mo.
ROY OLLIS WILHAM, Cincinnati, Ohio
HAL ERIC WILSON, Topeka, Kans.
VICTOR OWEN WILSON, Buffalo, N. Y.
RICHARD THEODORE WORTHINGTON, Corvallis, Oreg.

Applying for Associate Member

CLARK HENRY ALEXANDER, Mobile, Ala.
MOISES BENDAHAN, Caracas, Venezuela
CURTIS EDWARD BOTTUM, JR., Lorain, Ohio
JAMES JOHN BOWEN, Buffalo, N. Y.
HERBERT WILLIAM BURNS, JR., San Pedro, Calif.
GUY CASTIER, Rio de Janeiro, D. F. Brazil
JAMES WILLIAM CORNISH, Wellington, New Zealand
PAUL DAY CRIBBINS, Lafayette, Ind.
JOHN ARTHUR DEARINGER, Lexington, Ky.
ROY ARLON ENGLER, Austin, Tex.
ERICH GUSTAV GLOFF, Chicago, Ill.
THOMAS ALBERT HANSON, Roanoke, Va.
JOHN WORCESTER HOWE, Montreal, Que., Canada
ELMO WILLIAM HUFFMAN, Sacramento, Calif.
PAUL RICHARD JOHNSON, Chicago, Ill.
DELBERT LINELLE LACEY, Topeka, Kans.
GEORGE LAND, JR., Lexington, Ky.
DOUGLAS RAY LEE, Rolla, Mo.
WILLIAM JACOB LINDEMANN, Spartanburg, S. C.
PHILIP MALCOLM LINSCOTT, Los Angeles, Calif.
LEON JOHN MARSHALL, Ottawa, Ontario, Canada
ANTHONY VALENTINE MUNCH, Omaha, Nebr.
GEORGE PAUL MUSCHANOW, San Francisco, Calif.
BERNARD HEALY NEWMAN, London, England
TANEMI OBATAKE, Los Angeles, Calif.
JOHN HENRY PARISH, Omaha, Nebr.
HERBERT ALFRED PONTIER, Hingham, Mass.
YARABATI SATYA NARAYANA RAO, Elgin, Ill.
PAUL GUDME RASMUSSEN, Arlington, Va.
NOORALDEEN MOHAMED RIDHA, Van Nuys, Calif.
MARION AUGUST ROARK, Tulsa, Okla.
JESSE CHARLES SAEMANN, JR., Madison, Wis.
KOLBJORN SAETHER, Chicago, Ill.
RONALD FRASER SCOTT, Pasadena, Calif.
WILLIAM STARK SPANGLER, Arlington, Va.
RAEBURN BRACKETT STILES, Nashville, Tenn.
KAM SHING YUEN, New York, N. Y.

Applying for Junior Member

ALBERT HALL BARNES, JR., Knoxville, Tenn.
KENNETH GUY CARLSON, Baraboo, Wis.
GILBERT PIERRE CHEVALIER, New York, N. Y.
JAMES PITTENGER COLLINS, Cambridge, Mass.
JAMES DOUGLAS COOKE, Tacoma, Wash.
LAWRENCE NORWOOD DALLAM, Columbia, Mo.
MOHAMED TAG EL DIN EL SAHLY, Cairo, Egypt
THOMAS ANTHONY GRAHAM, Philadelphia, Pa.
JOHN WILLIAM HENNING, Ridgefield, N. J.
PAUL ALLEN JOHNSON, Chicago, Ill.
ALEXANDER RAY LOVE, Oakland, Calif.
JOHN PHILIP MARSHALL, Houston, Tex.
ALLAN FRANCIS MASON, Greenville, S. C.
RONALD THEODORE MCLAUGHLIN, Pasadena, Calif.
MOHAMED SAMIR MOUDARRES, Stanford, Calif.
MALLIPATNA SHANKARNARANAPPA NARAYANASWAMY, Banaras, India
GANESAN RAMAN, Hyderabad Deccan, India
DONALD LAWSON RUNYON, St. Albans, W. Va.
GERALD STANLEY SAUNDERS, Ottawa, Ontario, Canada
JAMES POSGATE STEVENS, Mexico, D. F. Mexico
TERRANCE DARCY THIELEN, Los Angeles, Calif.
GEORGE HAMILTON WATSON, Ontario, Canada
JOHN CHI HYONG WOO, Lansing, Mich.
SUEY TING YEE, Jackson, Mich.

[Applications for Junior Members from ASCE Student Chapters are not listed.]

Recent Books

(Continued from page 102)

Zehnteilige Einflusslinien fur Durchlaufende Trager, Volume II

Seventh Edition

This second volume of a set of three on ten-division influence lines for continuous beams, contains tables of moments, shearing forces and reactions for continuous beams of from 2 to 5 spans. The tables are divided and organized in such a way that any of a wide range of equal and unequal span combinations can readily be found. Descriptive text material illustrating the use of the tables is included. The volume has been considerably enlarged in the new edition. (By Georg Anger. Verlag von Wilhelm Ernst & Sohn, Berlin, Germany, 1958. 276 pp., bound. 41 DM.)

Non-ASCE Meetings

Alabama Highway Conference. Second annual meeting at the Alabama Polytechnic Institute in Auburn, March 16-17. Contact A. S. Chase, General Chairman, Second Annual Conference, Alabama Polytechnic Institute, Auburn, Ala.

American Concrete Institute. Annual meeting at the Statler Hilton Hotel, Los Angeles, Calif., February 23-26. Information available from Charles L. Cousins, ACI, P. O. Box 4754, Redford Station, Detroit 19, Mich.

American Institute of Electrical Engineers. Winter general meeting at the Statler and Sheraton-McAlpine Hotels, New York City, February 1-6. Further information available from Raymond C. Mayer & Associates, 36 W. 46th St., New York 36, N. Y.

American Institute of Mining Engineers. Annual meeting at the St. Francis, Sheraton-Palace and Sir Francis Drake Hotels, San Francisco, Calif., February 15-19. For information write AIME, 29 W. 39th St., New York 18, N. Y.

American Road Builders Association. Fifty-seventh annual meeting at the Adolphus Hotel, Dallas, Tex., January 19-22. Inquiries to the ARBA, World Center Building, Washington 6, D. C. Post-convention air cruise to Mexico, "Trip A" January 22-28, "Trip A & B" January 22-February 1. Write for reservations, Joseph M. Moran, Convention Manager, United States Travel Agency, 807 15th St., N.W., Washington 5, D. C.

American Society of Heating and Air-Conditioning Engineers. Sixty-fifth annual meeting at the Bellevue-Stratford Hotel, in Philadelphia, Pa., January 26-29. For further details write ASHAE, 62 Worth St., New York 13, N. Y.

American Society for Testing Materials. Committee Week at the Penn-Sheraton Hotel, Pittsburgh, Pa., February 2-6. Information available from the Society, 1916 Race St., Philadelphia, Pa.

Eastern Snow Conference. Annual meeting at the Massachusetts Institute of Technology in Cambridge, February 5-6. Headquarters for the conference will be the Commander Hotel, Cambridge, Mass. For further information write Gordon R. Ayer, Secretary, Eastern Snow Conference, P. O. Box 948, Albany 1, N. Y.

Institute of Transportation and Traffic Engineering of the University of California. Eleventh California Street and Highway Conference at Berkeley, January 29-31. Information from the ITTE, University of California, Berkeley, Calif.

Louisiana State University. Twenty-second Annual Short Course for Superintendents and Operators of Water and Sewerage Systems at the University,

(Continued on page 108)

PROGRESS REPORT FROM KANSAS

Known across the Nation as a leading producer of wheat, beef, and aircraft, Kansas is also playing an important role in the road building program.

Progress reports from bridge engineers show that reinforced concrete construction is the principal type being used. These reports also mention that there are several hundred bridges in Kansas which are constructed exclusively of reinforced concrete.

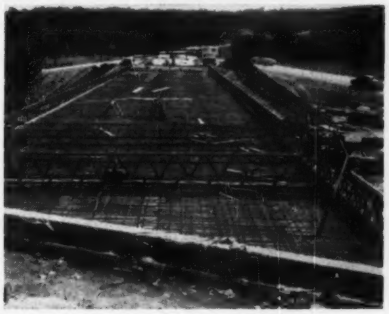
More and more highway engineers in many other states are finding, too, that their bridge and grade separation structures are being completed on schedule when they design in REINFORCED CONCRETE.

New Kansas bridges take shape on schedule with REINFORCED CONCRETE

Photographs courtesy of State Highway Commission of Kansas, Topeka.

Reinforced concrete box bridge construction on Highway US-40, Hays Bypass, Hays, Kansas.

Paving reinforced concrete road section on Highway US-50 at Strong City, Chase County.



Reinforcing bars shown in place on bridge before pouring deck on Highway K-58, northeast, Johnson County.

Pouring concrete on deck of hollow core slab of reinforced concrete bridge on Highway K-58, northeast, Johnson County.

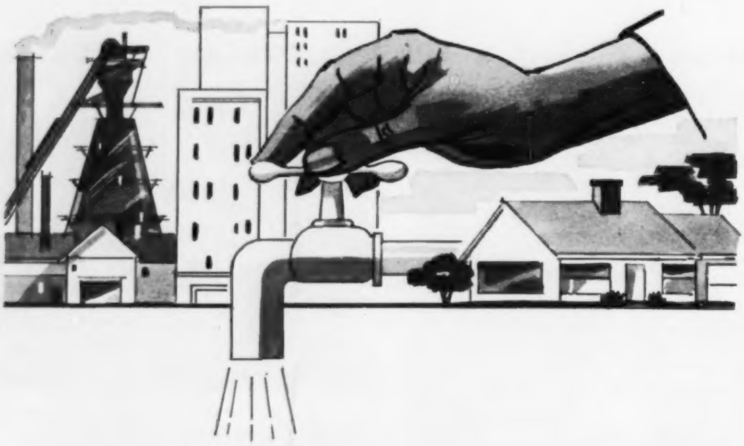
CONCRETE REINFORCING STEEL INSTITUTE C.R.S.I. FOUNDED 1924

Concrete Reinforcing Steel Institute
38 South Dearborn Street, Chicago 3, Illinois

Positions Announced

Public Health Service. Vacancies for Assistant and Senior Engineer Officers starting salaries $4,817 and $6,270. Applicants must take a competitive examination which will be held April 21, 22, 23, and 24 on a nationwide basis, be at least 21 years old, a U.S. citizen, a graduate from a recognized college or university, and have at least three additional years of professional training and experience. Those applying for the Senior Assistant Sanitary Engineer rank must have a minimum of ten years total training and experience. For further information, and application forms, write Surgeon General, United States Public Health Service (P), Washington 25, D. C.

Army Corps of Engineers. Vacancies in the St. Paul Army Engineer District for Hydraulic Engineers, GS-11 and GS-9, for hydraulic design for civil and military construction projects. Also Civil Engineers, GS-11 and GS-9, for design work involving soils and foundation problems. Salary range $6,285 to $8,230 per annum. Send applications to U.S. Army Engineer District, 1217 U. S. Post Office and Custom House, St. Paul 1, Minn.



Non-ASCE Meetings

(Continued from page 106)

March 18-20. Address inquiries to the University at Baton Rouge, La.

National Association of Corrosion Engineers. Fifteenth annual NACE conference and Corrosion Show at Chicago, March 16-20. Details from NACE, T. J. Hull, Executive Secretary, 1061 M & M Building, Houston 2, Tex. Canadian Region meeting in Montreal, Quebec, January 12-14, and in Calgary, Alberta, February 11-13. Write B. H. Levelton, B. C. Research Council, University of British Columbia.

Plant Maintenance and Engineering Conference. Tenth anniversary show and conference sponsored by Clapp & Poliak, Inc., at the Public Auditorium, Cleveland, Ohio, January 26-29. Advance registration cards for both the show and conference may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

Society of Plastics Engineers, Inc. Fifteenth annual conference at the Hotel Commodore, New York City, January 27-30. For advance registration apply to SPE, 65 Prospect Street, Stamford, Conn.

Texas Society of Professional Engineers. Annual convention at the Shamrock Hilton Hotel, Houston, Tex., January 22-24. For information write San Jacinto Chapter, Texas Society of Professional Engineers, Houston, Tex.

University of Illinois. Forty-fifth Annual Illinois Highway Engineering Conference, February 24-26. Eleventh Annual Illinois Traffic Engineering Conference 26-27. Both at the University's Urbana campus. Information from the university.

University of Kansas Extension Center. Second annual Midwest Work Course on Materials Handling Analysis in Kansas City, February 2-7. For further information write Edward S. Avison, University of Kansas Extension Center, 39th & Rainbow Blvd., Kansas City 12, Kansas.

University of Utah. Twentieth Annual Highway Conference sponsored by the Department of Civil Engineering, University of Utah, Salt Lake City, Utah, March 3-4. Information from Grant K. Borg, Head, Department of Civil Engineering, University of Utah, Salt Lake City, Utah.

Virginia Department of Highways. Tenth Annual Symposium on Geology as Applies to Highway Engineering, to be held in the Architectural Building of Georgia Tech Institute, Atlanta, February 20. For information write W. T. Parrott, Chairman, Steering Committee, Highway Geologist, 1221 East Broad St., Richmond, Va.

A project of the Corning Glass Works, this structure is to be known as 717 Fifth Avenue. Instead of designing the building flush with the sidewalk line, the architects provided a pleasant 3000 sq-ft landscaped plaza at the corner of Fifth Avenue and 56th Street.

Tower of glass on Fifth Avenue

BOLTED, OF COURSE!

The entire skin of this 28-story building is glass—4½ acres of green-tinted, heat-absorbing glass. These glass curtain walls are supported by a framework of steel fabricated and erected by Bethlehem. Field connections of the steel frame were made with 63,960 high-strength structural bolts, nuts, and washers.

Bethlehem high-strength bolts are quickly installed with a pneumatic impact wrench to provide permanently tight joints. Bolts are safer, since there's no fire hazard, nor any danger of injury from tossed rivets. Bolting is quieter, ideal for use in hospital and school zones.

Bethlehem high-strength bolts, nuts and washers are made of carbon steel, heat-treated by quenching and tempering. They meet every requirement of ASTM Specification A-325.

One of our engineers will be glad to give you full details. A call to the nearest Bethlehem sales office will bring him to your desk promptly. Or write direct to us at Bethlehem, Pa.

Architect: Harrison and Abramovitz and Abbe; *structural engineer:* Edwards & Hjorth; *general contractor:* George A. Fuller Company; *steelwork:* Bethlehem Steel Company.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

New Scrapers

SELF-PROPELLED AND TRACTOR drawn scrapers, ranging in size from 7 to 30 cu yd struck capacity and rear dump models in sizes up to 35 tons capacity, mark the Curtiss-Wright Corporation's full scale entry into the construction equipment field.

Largest addition to the 14-model line, the CW-226 is a two-axle scraper with a struck capacity of 26 cu yd and a heaped capacity of 36 cu yd. Two other top performers in the earth moving field are the CW-220, possessing a 20 cu yd struck capacity and a 27 cu yd heaped capacity, and the CW-215, with a 15 cu yd struck and a 21 cu yd heaped capacity.

Both the CW-226 and the CW-220 are powered by a 375-hp, GM6-110T diesel through an Allison automatic transmission and torque converter, providing horsepower at rated capacity and road speeds ranging up to 35 mph with full load. The CW-215 is powered by a 240-hp, Cummins diesel.

One of the outstanding features of all of these models is the exclusive "Roto-Gear" steer, a hydraulic system which provides constant torque throughout the entire steering cycle.

To increase equipment utility, both the CW-226 and the CW-220 scrapers are interchangeable with a 35-ton rear dump unit which utilizes a Torqmatic brake for hydraulic retarding and control on steep grades. **Curtiss-Wright Corp., CE-1, Wood-Ridge, New Jersey.**

The Unimog

A UNIQUE ON-AND-OFF the highway vehicle, combining the best features of a light truck, tractor and prime power source in one unit, well proved in Europe, is now being marketed in the United States by Curtiss-Wright.

A development of Daimler-Benz, A.G. of West Germany, the Mercedes-Benz Unimog is an all-purpose unit adaptable to the construction field, utilities, mining and forestry, agriculture, industrial, municipal and military uses.

Available in three basic models, with payload ratings of 1, 1½ and 2 tons, the vehicle is powered by a four cylinder, water cooled, 35-hp (SAE) diesel engine. Another model is available with a six cylinder, 92-hp water cooled gasoline engine.

The Unimog has shown tremendous tractive power, including the ability to pull 20 times its own weight, accomplish a 60-deg climb or a 38-deg traverse with full payload; and travel at speeds ranging from 0.2 mph to 35 mph. Six normal forward speed and two reverse speeds are available on all models. **Curtiss-Wright Corp., CE-1, Wood-Ridge, New Jersey.**

Tremendous Tractive Power

Spread Footing Forms

DESIGNED TO PERMIT CONCRETE footings and foundation walls to be poured at the same time, a new type of spread footing forms has been developed.

These are constructed for use with regular EFCO Form Equipment. By pouring footings and walls in one operation, important savings result in time and labor; construction is speeded-up by eliminating the need for footings to harden before pouring walls.

Spread footing forms are all steel, thus permitting hundreds of re-uses. Standard height of forms is 10 in.; the height of footings cast is 8 in. Forms are produced in lengths of 96 in., 48 in., 24 in., and 12 in. Spread corner forms for inside and outside are also available. **Economy Forms Corp., CE-1, Box 128-G, Highland Park Station, Des Moines, Iowa.**

New Fastening Available

BY CONSOLIDATING IN ONE HEX bolt and hex nut the best features of four other types of fasteners, the common square headed bolts and square nuts are expected to be obsoleted as standard fasteners. Advantages to the industry, according to the company, are an improved quality of fastener which affords a better appearing, lighter weight finished product.

Under the company's program, a hex bolt and hex nut can replace these four products: square machine bolt with rolled thread, square nut; square head machine bolt with cut thread, square nut; hex head machine bolt, hex nut; and bright cap screw with National Coarse Thread in the solid die range (generally the smaller diameters and shorter lengths), separate nut. **Russell, Burdsall & Ward Bolt & Nut Co., CE-1, 103 Midland Ave., Port Chester, N. Y.**

Model Basin

THE U.S. NAVY will soon be able to test the seaworthiness of ships in a new model basin at Carderock, Maryland.

The David W. Taylor model basin will permit the admirals to blow up a storm by using specially constructed "wavemakers". In addition to creating storms at sea, the basin will simulate shore conditions during bad weather for testing landing craft.

Large rubber bags are sealed into wave-generating weldments in the model basin. Turbulent water conditions are produced by the rapid inflation and deflation of these bags. **H. W. Butterworth & Sons Co., CE-1, 952 Philmont Road, Bethayres, Pa.**

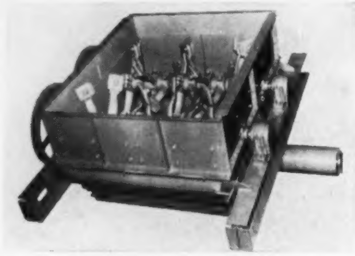
EQUIPMENT MATERIALS and METHODS

(continued)

Asphalt Mixer

A NEW ASPHALT MIXER to produce a closely knit mix and uniformity throughout a batch has been developed.

The mixer is of twin shaft design with the shanks and tips arranged for spiral "run around" and the high chromium alloy tips can be attached to the cast steel shanks with 16 possible adjustments.



Twin Shaft Design

Damage from severe abrasive action is minimized by using the same high chrominum alloy in the mixer gates and liners. The 16 liners are overlapped, reducing the need for a large number of bolts, and the four liners at the mixer gate extend down into the gate opening to fully protect the shell wall at this point.

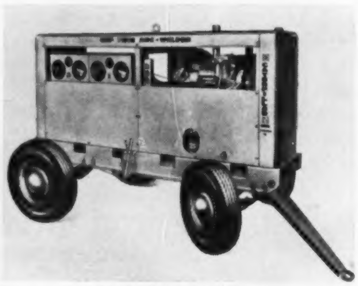
The gate is activated by a pneumatic cylinder under push button control and operated with either air or steam.

Bollard Asphalt Plant Div., The Colonial Iron Works Co., CE-1, 17625 St. Clair Ave., Cleveland 10, Ohio.

Twin Arc-Welder

THE NEW PORTABLE Twin Arc-Welder uses the Cat D311 (Series H) Diesel Engine and two Lincoln Electric Welding Generators.

The generators each have a rating (NEMA) of 300 amps at 40 volts for



Portable Welder

(Continued on page 113)

simultaneous operation of two arcs. For parallel operation the welder is rated at 600 amps, 40 volts. The current range of each generator is 60 to 375 amps.

Two sets of generator controls allow welding at different voltages, amperages and polarity at the same time to permit precision adjustment for any type or size arc.

A 3-kw capacity exciter provides a constant source of magnetic flux to the generators. **Engine Div., Caterpillar Tractor Co., CE-1, Peoria, Ill.**

New Earthmoving Concept

A COMPLETELY NEW CONCEPT in earthmoving which promises to revolutionize dam-building and canal-digging methods has been introduced.

The machine which inspired this concept is a gigantic self-loading mountain mower, more than 100 ft long and with the power of a railroad locomotive.

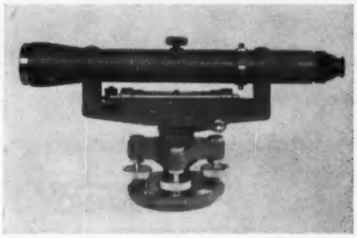
A single operator, with one hand on a panel of push-button controls, is in complete command of the house-size monster as it goes through each stage of its work. He can dig a boxcar full of dirt, haul the load to any desired location, and then spread the load with an even finish.

Self-Loading

So much power is built into the machine that two giant buckets are incorporated to hold the 130-ton load. Both buckets are integral parts of the machine; they can load themselves separately and discharge their loads either together or separately as the operation requires. **R. G. LeTourneau, Inc., CE-1, 2399 South MacArthur, Longview, Texas.**

Dumpy Level

THE STURDY CONSTRUCTION, FINE appearance, and especially the magnifying and resolving power of the 15-in. Dumpy Level (No. 15D2) make it a top product. It is recommended for long-distance surveys as in railroad, port and road construction work. Simple and easy to operate, it is strongly built and has the capabilities of the average 18-in. level, with 32X telescope and 26-sec vial; materials and workmanship are also the same.



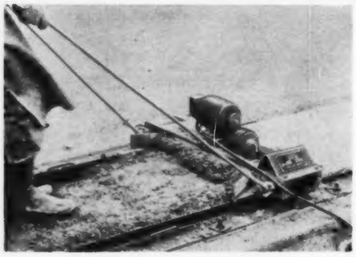
Accessories include a case made of fine polished plywood, tripod, sun shade, screw driver, dust brush and waterproof cover. **Texas-Asiatic Import Co., CE-1, 2127 Ft. Worth Ave., Dept. 1, Dallas 11, Texas.**

EQUIPMENT MATERIALS and METHODS

(continued)

Vibratory Screeds

Two NEW VIBRATORY SCREEDS designed especially for finishing prestressed concrete sections, utilizing Thor's exclusive high frequency slapping action to vibrate, compact, and level concrete in one operation, have been developed.



"Two-Beam" Construction

Model FSM-4, 4 ft long, and Model FSM-6, 6 ft long, have the unique "two-beam" construction with steel strapping vibratory mechanism.

With the screeds for precast work, an electric motor actuates a series of steel straps between the two beams, the resultant slapping action forcing out water and air and producing dense, compact, hard-surfaced concrete. Tests in the production of thousands of square feet of prestressed concrete sections have shown the screeds to be exceptionally low in maintenance because of their simplicity of design. **Thor Power Tool Co., CE-1, 175 N. State St., Aurora, Ill.**

Dipper Dredge

THE FIRST MODERN DIPPER dredge built completely as such in nearly 25 years was finished recently. Constructed for the American Dredging Co. of Philadelphia, the "President" features several highly individual design items, greatly facilitating operational efficiency.

Not simply a dry-land machine mounted on a barge, the dredge is designed in its entirety as a marine excavator. Of six cu yd capacity, it is engineered to dig to a depth of 47 ft and will excavate blasted rock, boulders, compacted clay, and similar materials.

The dredge can deliver the dredged material into dump barges moored alongside within a normal reach of 58½ ft and at a clear height from the water level to the bottom of the open dipper door of 16½ ft. The dredge's boom is 60 ft long. **Ellicott Machine Corp., CE-1, 1611 Bush St., Baltimore, Md.**

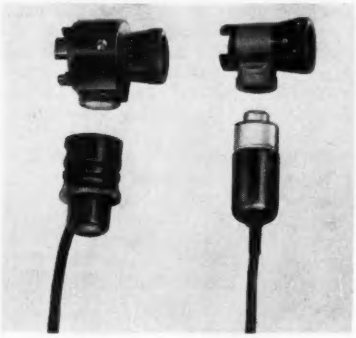
EQUIPMENT MATERIALS and METHODS

(continued)

Autocollimation Eyepieces

HIGH POWER AND QUICK interchangeability are features of the new Autocollimation Eyepieces, which extend the use of the T-2 and T-3 Theodolites in optical tooling operations, such as directioning and testing gyros, checking gears, setting fixtures, and others.

Total telescope magnification of 22X is achieved with the T-3, which gives a reading accuracy of 0.2 sec of arc. T-2 magnification is 18X with reading accuracy of 1 sec.



Quick Interchangeability

No adaptation is necessary to accommodate the eyepieces when using the T-3. They are immediately interchangeable with the standard telescope eyepieces by loosening two screws. Once a small modification has been made on the T-2, it offers the same ease of changing eyepieces. **Wild Heerbrugg Instruments, Inc., CE-1, 366 Main St., Port Washington, L. I., New York.**

Pipes for Skyway

HIGH ABOVE THE CALUMET River in Chicago rises the $101,000,000 Calumet Skyway, which brings the Pennsylvania, Ohio, and Indiana Toll Road system into the heart of Chicago. Nearly 400 tons of wrought iron pipe were specified for drainage lines on the 7½-mi stretch.

Selection of the pipe stemmed from an environmental factor. Heavy snow fall and resultant hazardous driving conditions will keep the Chicago Skyway crews sanding and salting the new highway. So, in addition to atmospheric corrosion, water impregnated with sodium chloride presents a threat to such drainage systems. New 4-D wrought iron pipe is especially suited for use in this corrosive environment. **A. M. Byers Co., CE-1, Clark Bldg., Pittsburgh, Pa.**

EQUIPMENT, MATERIALS and METHODS

(continued)

Sand Spreader

Summer

Winter

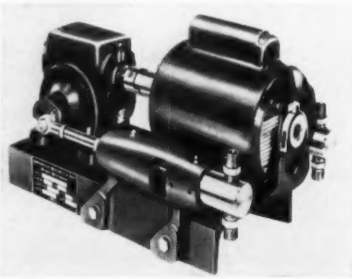
DESIGNED FOR MOUNTING ON any standard dump truck in 15 minutes, the new model dual-purpose spreader, for highway seal-coating in summer and de-icing in winter, incorporates many improvements.

Though still providing manual feed and throttle control easily reached through the cab window by the truck driver, it offers an electrical control panel that permits the driver to regulate material with split-second efficiency from the dashboard without exposure to weather. Replacing a mesh-type screen, the new protective cover grid is made up of ⅜-in. rods spaced 3 in. apart and centered in ¼ x 2-in. crossbars. The grid is made in hinged sections so that each section can be easily handled by one man. A new easy-working lever adjusts the height of the spinner to regulate the width of the spread in four steps from 8 ft to 40 ft with most materials. The spinner is now detachable for easy storage and can be attached or detached from the body of the spreader in a few minutes. **Fox River Tractor Co., CE-1, 1020 North Rankin St., Appleton, Wis.**

New Proportioning Pumps

THESE RUGGED, DEPENDABLE, CONTROLLED capacity pumps have been developed to handle many applications in such industries as petrochemicals, chemicals and water treatment, particularly in power production.

Series 100 Simplex models handle capacities ranging from .65 gal per hour to a maximum of 13.10 gal at a maximum pressure of 1000 lb per sq in. Duplex Series 100 models are rated at double the capacities of the Simplex models. Capacity regulation is easy and accurate. A screw adjustment on the crank adjusts the stroke while the pump is stopped. Stroke length is adjustable from 0 to a maximum of 1½ in. Repetitive metering accuracy within a tolerance of (plus or minus) 1% is obtained when the pump operates between the limits of 10% to 100% of stroke length.



Spherical self-aligning bearings on both the crank and plunger ends of the connecting rod ensure longer service life by taking greater radial and axial thrust loads than more common types of bearings. Nylon dust covers assure the long life of the heavy duty spherical, lubricated, self-aligning bearings by preventing dirt and dust from entering the bearing surface and mixing with the bearing lubricant. **Pump Div., American Meter Co., CE-1, 1523 Race St., Philadelphia, Pa.**

High Strength Wire Rope

AFTER SEVERAL YEARS OF rigid testing, refining and development a new extra high strength wire rope called Double Gray has been produced.

It has been extensively field tested on rotary rigs, dozers, shovels, draglines, scrapers, tractors, arch tractors and every type of machine that imposes heavy loads on rope. Made of extra improved plow steel, it is fortified by an independent wire rope core of the same extra high strength steel. Double Gray rope has a 15% higher breaking strength than the catalog breaking strength of an improved plow steel rope with IWRC. **Wickwire Spencer Steel Division of The Colorado Fuel & Iron Corp., CE-1, 575 Madison Ave., New York 22, New York.**

EQUIPMENT MATERIALS and METHODS

(continued)

Unique Bonding Material

INTRODUCED AS A LABORATORY curiosity only a year ago, Eastman 910 Adhesive is now solving a wide variety of difficult assembly problems involving the joining of almost every kind of material from minerals to rubber. It will be made commercially available both through the company's Chemical Division and through the Industrial Division of Armstrong Cork Co., long-time specialists in the industrial adhesive field.

According to the manufacturer, this is the first bonding material developed that produced high strength bonds between virtually any combination of materials without the necessity for excessive pressure, heat solvent-evaporation, or long curing time.

Commercially Available

The new adhesive has been used in solving production assembly problems for such products as trophies, fountain pens, high-fidelity phonograph cartridges, radiation measuring instruments, strain gages, rubber swimming masks, tools, rubber imprinting plates, and automobile storage batteries. **Eastman Chemical Products, Inc., CE-1, Kingsport, Tenn.**

Copyflo Continuous Printer

A MICROFILM CAMERA, a supply of tabulating cards, each die-cut to hold a single frame of film, and a xerographic device called a Copyflo 24 continuous printer that automatically spews out printed material at the rate of 20 ft a min have been brought together to solve

(Continued on page 118)

a reproduction problem that has plagued the engineering profession for years.

The problem is one of copying engineering drawings quickly, accurately, and inexpensively. Unitized microfilm systems and xerography are offered as a solution. Although microfilm is a proven intermediate, to enlarge the film back into workable prints by conventional methods on such a high volume basis is prohibitive.

That's where xerography comes in. It is a near-instantaneous copying process that automatically reproduces from microfilm onto plain, unsensitized paper. It turns out dry, inexpensive black-and-white prints of good quality, photographically accurate, and up to 24 in. wide. **Haloid Xerox Inc., CE-1, Rochester 3, New York.**

Giant-Size Gradall

Model G-100

THIS "BIG BROTHER" TO the present Gradall has a capacity of 1¼ yd making it the largest all hydraulic machine in the world, the manufacturer states. Labeled Model G-100 this machine has a standard digging depth of 17 ft that can be easily increased to 23 ft with boom extensions. Its reach of nearly 31 ft can be increased to nearly 47 ft with these same boom extensions. The Gradall has a continuous 360-deg swing and the ability to lift up to 14,000 lb. It possesses a boom tilt (rotation on the boom's long axis) of 120 deg with a 360-deg boom tilt available as an optional feature.

Two 100-hp diesel or gasoline engines give the machine plenty of power for the toughest digging. These units provide a constant supply of hydraulic power through two separate 3-section tandem pumps, flange mounted directly to the engines. **The Warner & Swasey Co., CE-1, 5701 Carnegie Ave., Cleveland, Ohio.**

Zinc-Coated Sheets

HIGHWAY GUARDRAILS THAT ARE stronger, lighter and more corrosion-resistant, now can be fabricated of a new grade of zinc-coated sheets made from a high strength, low alloy grade of steel, Jalten No. 2.

The chief advantage of the product is that it provides greater strength with less weight. In addition to guardrails, it is expected that the product will be widely

(Continued on page 119)

Advance Information on Attendance at ASCE Los Angeles Convention

This is not an advance ticket order. Do not send payment. No name is needed.

To: MR. TRENT R. DAMES
General Chairman
Los Angeles Convention Committee, ASCE
816 West Fifth St., Los Angeles 17, Calif.

It is my plan to attend the Los Angeles Convention of ASCE. I shall have ...... guests attending with me.

During the Convention I plan to attend the following events, tickets for which I shall purchase when I arrive and register:

FUNCTION	NO. OF TICKETS
Mon., Feb. 9	
Luncheon	.....
Ice-breaker Party	.....
Tues., Feb. 10	
Luncheon	.....
Smoker	.....
Wed., Feb. 11	
Luncheon	.....
Disneyland Trip	.....
Thurs., Feb. 12	
Luncheon	.....
Dinner Dance	.....
Fri., Feb. 13	
Luncheon	.....

Los Angeles Convention of ASCE
Hotel Statler-Hilton, Los Angeles, Calif. Feb. 9-13, 1959

(*Please print*)

Name ....

Street ....

City ....Zone......State....................

Mail to:

ASCE Convention Reservations
Hotel Statler Hilton, 930 Wilshire Blvd., Los Angeles 17, Calif.

Please reserve for my occupancy the following hotel accommodations:

Double ....Single ....

Double-twin beds ....Suite ....

Other ....

Date and hour of arrival ....

Date of departure ....

EQUIPMENT MATERIALS and METHODS

(continued)

used by the construction industry for roofing, siding, flooring and the fabrication of angles, channels and other structural members.

It has a tight, hot dipped zinc coating that will not flake in forming. The need for hot dipping after forming also is eliminated, thus saving time and money. **Jones & Laughlin Steel Corp., CE-1, 3 Gateway Center, Pittsburgh 30, Pa.**

Industrial Tractor

A TRACTOR-LOADER INDUSTRIAL "package" with two and a half times the lift capacity of any of the company's previous loader units has been announced.

Larger and heavier than the general-purpose tractors, the new machine, with a 7000-lb capacity front axle and heavy weight-bearing frame, has unequalled ruggedness. Its strength and capacity to withstand batterings and shock-loads is derived from a new concept of isolating such vital "equipment" as the driver,

7,000-Lb Capacity Front Axle

engine, hydraulic pumps, and steering system from the members of the tractor which take the biggest beating in industrial service.

A revolutionary all power steering system with exclusive "feather touch" instant response, and with a steering wheel requiring less than a complete turn to go from straight ahead to full right or full left, provides quick maneuverability and isolates the driver from kickback. Effort and fatigue for the operator is minimized. **Tractor & Implement Div., Ford Motor Co., CE-1, 2500 E. Maple St., Birmingham, Mich.**

Literature Available

SLUICE GATES—The Water Control Equipment Issue of the "Orange Peel", a monthly house organ, contains a description of the installation of HY-Q Sluice Gates at the Thos. H. Allen Electric Generating Station in Memphis, Tenn. Ranging in size from 84 in. x 84 in. to 120 in. x 190 in. and weighing in excess of 309 tons, these gates provide complete and dependable control of all the water required for cooling and other circulating uses in the station. Nine of them are designed to withstand an unseating head of 108 ft. **Rodney Hunt Machine Co., CE-1, 59 Mill St., Orange, Mass.**

GEODIMETER—This pamphlet contains a brief description of the Model-4 Geodimeter, a compact, lightweight surveying instrument ideal for use in rough terrain when carrying on the following tasks: photogrammetry and traversing on short lines, highway and bridge layout and staking, and calibration of short range radar. During operation, the instrument is mounted on a European-style theodolite tripod. **Berg, Hedstrom & Co., Inc., CE-1, 1170 Broadway, New York 1, N. Y.**

AUXILIARY UNITS—This 16-page brochure contains descriptions of some of the component units of the Simplicity Plant, which are designed and built exclusively for use on asphalt plants. The feeders and feeder bins are designed with adjustable gates or for variable speeds to insure accurate, reliable feed. The Double Shell Dryer starts at once without warming up and stops immediately without cooling down. The mixers have ¾-in. thick manganese steel liner plates, extra large carbon steel mixer shafts, and cut tooth steel spur gears. Large, clear illustrations are also included in the pamphlet. **The Simplicity System Co., CE-1, Riverside Drive, Chattanooga 6, Tenn.**

METHODS FOR SURVEYORS—This 48-page booklet contains a set of methods composed of contributions by many engineering friends and members of the company's sales force. Practical examples show how simple it is to solve many surveying problems. Some of the subjects which are discussed are cube roots, concrete calculations, tangent grade elevations, the law of cosines and the survey of an area. **Friden, Inc., CE-1, 2350 Washington Ave., San Leandro, Calif.**

MATERIALS HEATER—A booklet has been published which discusses the Materials Heater, a self-contained heating unit mounted on wheels. It eliminates boiler or oil heater, material tanks, oil tanks, water tanks, and piping and pumps. General specifications for the Model 106-O and Model 106-S and clear photographs are included. **Industrial Boiler Company, Inc., CE-1, Box 9133, Chattanooga, Tenn.**

Literature Available

ELECTRIC PUMP—New literature is available on portable, fully submersible electric pumps for mining, contracting and general industrial use. One of the outstanding features of these pumps is their ability to handle a very high proportion of solids. In addition they will run for long periods without supervision, and will not suffer damage if allowed to run dry. Pumping starts again instantly when water flows into the sump. Flygt pumps will drain water down to an inch in depth, are easily moved around and require no suction hose or installation. **Stenberg Mfg. Corp., CE-1, Hoosick Falls, N. Y.**

ALIDADES—A 36-page, pocket-size service booklet on the use and adjustment of alidades has been published. The revised edition of Service Booklet "C" includes, for the first time, tables by which the field man can obtain horizontal distances and elevations from stadia readings. The illustrated brochure also has helpful information for use of the alidade in both exploration and map-making, as well as detailed instructions on stadia surveying and use of the Beaman Stadia Arc. Other subjects covered are: alidade adjustment, striding level, cross-level rectification, collimation, and control level. **Alidade Dept., W. & L. S. Gurley, CE-1, Troy, New York.**

PRESTRESSED CYLINDER PILES—A new 26-page catalog describing design, construction and installation of prestressed concrete cylinder piles has been made available. The literature states that the cylinder piles are manufactured by casting 16-ft long sections, placing them end to end and stringing together with high-strength cables. After all the cables have been tensioned by means of jacks, the ends of the cables are anchored temporarily with metal locking cones. Cement grout is pumped into the cable holes under pressure, and after the grout has hardened the locking cones are removed. **Raymond International Inc., CE-1, 140 Cedar St., New York 6, N. Y.**

FREE RESEARCH & PHOTOGRAPH SERVICE—A brochure announcing the initiation of a free research and photographic service for home and do-it-yourself editors of newspapers and magazines has been published. It contains nine reproductions with appropriate descriptive material depicting various outdoor uses of Visqueen polyethylene film around the home. Intended to assist the editors in preparing their fall and winter features, the editors can obtain original, 8 x 10 photographs of the offered material free just by circling the proper numbers on the postage-free postcard. **Visking Co., Plastics Div., CE-1, P.O. Box 1410, Terre Haute, Indiana.**

Films Available

"The Red Strand"—A trip through the world's most modern wire mill is described in detail in a new color-sound movie, which shows the process of producing finished wire from rod, going through the steps of patenting, cleaning, coating, drawing, and spooling. The straight-through process, with a minimum of material handling, is well illustrated. A feature is an explanation of the many tests that are made in the company's laboratories to maintain the high quality of Red-Strand wire rope and prestressing strand. **Leschen Wire Rope Div., H. K. Porter Co., Inc., CE-1, 2727 Hamilton Ave., St. Louis 12, Mo.**

Corrosion—The 19-min film tells what causes anodes and cathodes to form on steel surfaces, how they produce electrolytic corrosion, what can be done about it. It discusses inhibitors, alloys, hot-dip galvanizing, cathodic protection, metallizing, organic coatings and Dimetcote inorganic zinc coating. Case histories show how corrosion problems are solved in various industries. **Amercoat Corp., CE-1, 4809 Firestone Blvd., South Gate, Calif.**

"People & Movement"—Produced as a public service, this 17-min sound-color film discusses the changes in America's population and how these changes are affecting land use and movement in urban, suburban and rural areas of the nation. Photography from all over the country shows super expressways, redevelopment models, slum clearance projects and rural industrial developments. **Portland Cement Association, CE-1, 33 West Grand Ave., Chicago 10, Ill.**

Tractor Shovel Service—Seven 20-min color sound-slide films have been produced which teach the care and maintenance of "Michigan" Tractor Shovels. The strip films are pitched to the semi-skilled mechanic—someone familiar with basic materials handling machinery and servicing tools but unfamiliar with torque converters or power-shift transmissions. Step-by-step procedures are projected slowly frame-by-frame as a long-play record explains the technique in simple language. **Clark Equipment Co., Construction Machinery Div., CE-1, Pipestone Road, Benton Harbor, Mich.**

Hortonsphere—A 16-mm sound film tracing the evolution of a 190-ft dia steel sphere, built to house an atomic reactor, has been produced. The giant Hortonsphere was designed, fabricated and erected for Commonwealth Edison Company's Dresden Nuclear Power Station, which is now nearing completion. Running time for the movie is 25 min. **Chicago Bridge & Iron Co., CE-1, 332 South Michigan Ave., Chicago 4, Ill.**

From the MANUFACTURERS

INCREASED EQUIPMENT COST: An increase in rental charges for most items of construction equipment is reflected in the 1958 "Compilation of Rental Rates for Construction Equipment", published by the Associated Equipment Distributors, the national trade association of construction equipment distributors and manufacturers . . . **REPRESENTATIVE APPOINTED:** Universal Manufacturing Corp., Zelienople, Pa., has concluded an agreement with the Hans Liebherr Co. of West Germany to serve as exclusive United States representative for the firm's Tower-cranes, hydraulic excavators, and automatic concrete batch plants . . . **MANUFACTURING AFFILIATE:** Farris Engineering Corp. and affiliated companies, Palisades Park, New Jersey, has announced the formation of a new manufacturing affiliate in England, Farris Engineering Ltd. The company has been formed under an agreement between Farris Engineering Corp., Farris Flexible Valve Corp. and Associated Automation, a subsidiary of Elliott-Automation of London, England . . . **AWARDED CONTRACT:** Bowman Steel Corp., sole distributors for American Steel Band Co., has been awarded the contract to furnish approximately 679,000 sq ft of cellular steel flooring for the new headquarters of the Bureau of Old Age and Survivors Insurance near Baltimore, Md. . . . **DISTRIBUTOR APPOINTED:** Field Machinery Co., Cambridge, Mass., has been appointed a Hydrocrane distributor for Bucyrus-Erie Co., South Milwaukee, Wis. . . . **CONTRACTS RECEIVED:** The Valve Division of the S. Morgan Smith Co. of York, Pa., announces the receipt of two sizeable contracts covering butterfly valves and Rotovalves. The firm will ship eighty-seven butterfly valves to the Hanford Works, Plutonium Fabrication Plant, in Richland, Wash. . . . **NEW COMPANY:** Buckeye Pipe Line Co. and Chicago Bridge & Iron Co. have announced the formation of a jointly owned company called Buckeye Tank Terminals, Inc. It will construct, own, and operate terminal tankage on the Buckeye Pipe Line system, or at other locations; and will lease or otherwise arrange for use of those facilities by a specified individual customer . . . **MERGER ANNOUNCED:** The Ramo-Wooldridge Corp., an affiliate of Thompson Products, Inc., since its inception five years ago, has been merged into Thompson Products, Inc. The agreement providing for the merger designates the name of the new combined company as Thompson Ramo Wooldridge Inc. . . . **NEW LOCATION:** The Harco Corp., designers of cathodic corrosion protection systems for industry, will occupy its new headquarters at 4600 East 71st St., Cleveland 25, Ohio . . . The Westinghouse Electric Corporation's switchgear distribution apparatus department is now located in its new ultra-modern plant three miles west of Bloomington, Indiana . . . **MANUFACTURING AGREEMENT:** Anglo-American collaboration in the service of world industry received a significant boost with the signing of a new manufacturing agreement between Armstrong Siddeley Motors Ltd. and Clark Bros. Co., Div. of Dresser A. G. Terms of agreement provided for licensed manufacture in the United Kingdom of gas turbines designed and made by Clark in the U.S.A. . . . **NEW PLANT:** A multimillion dollar Formica flakeboard plant with a production capacity of 40 million square feet yearly and described as the largest and most fully automated facility of its kind has been opened by Formica Corp., wholly-owned subsidiary of American Cyanamid Co. . . . **NEW FINANCE CORPORATION:** Formation of Koehring Finance Corp., a wholly-owned subsidiary of Koehring Co., has been announced. It will be capitalized initially with $1,000,000 of promissory notes, payable over 20 years beginning five years from now, and 2,500 shares of $100 par common stock. . . . **APPOINTMENTS:** Philip E. Carlson has been elected Assistant Vice President—Manufacturing of Lehigh Portland Cement Co. . . . Fred Dolton has been appointed district representative in the eastern area for Clark Equipment Company's Construction Machinery Division.

PRIVATE PRACTICE OF CIVIL ENGINEERING

THE Society's Committee on Professional Practice has spent several years on the revision of Manual 29. The result of this work is now available as Manual 38, "Private Practice of Civil Engineering for the Use of Engineers and Clients."

If you wish to receive a copy of this Manual, please use the accompanying order form.

----------CUT HERE----------

American Society of Civil Engineers
33 West 39th Street, New York 18, N. Y.

Please send......copy(s) of Manual 38 at a list price of $1.00 (50% discount to ASCE members). Enclosed is my remittance. Grade...................

NAME ....
Print Name

STREET ....

CITY ..................ZONE.....STATE..........
. . . OF M-38

PROCEEDINGS AVAILABLE

DECEMBER

Journals: Hydraulics, Soil Mechanics, Structural, Professional Practice, Waterways and Harbors, City Planning, Power, Irrigation and Drainage.

1859. Meteorological Aspects of Storm Surge Generation, by D. Lee Harris. (HY) A hurricane model which describes the pressure and wind distributions, suitable for use in hurricane storm tide studies, is presented. Statistical relations between hurricane intensity and extreme tide heights are given.

1860. A Method of Financing Ground Water Replenishment, by Howard W. Crooke. (IR) A program of financing ground water replenishment by a dual tax structure that provides the major source of revenue is outlined in this paper.

1861. Statewide Water Planning, by Harvey O. Banks. (IR) This paper examines the importance of long-range planning in the development of water with particular reference to water development in California.

1862. Model Approach to a Ground Water Problem, by Kenneth R. Wright. (IR) When adverse field conditions preclude a direct field investigation of a ground water problem, models can be utilized to advantage to determine directions of flow, velocities, location of hydraulic divides, and to forecast conditions which may occur in the future.

1863. Settlement of Oil Storage Tanks, by Andrew W. Braswell, Jr. (SM) A review of the actual settlement of steel storage tanks with a description of the soil conditions at each tank is given. Construction procedures employed to improve foundation conditions are described, and a comparison is made of theoretical and observed settlements for the particular area.

1864. Design and Construction of the Ambuklao Rock Fill Dam, by E. Montford Fucik and Robert F. Edbrooke. (SM) The problems of designing and constructing a vertical-core rock fill dam are described in this paper. Records of settlement and seepage after operation at maximum reservoir level bear out the adequacy of design and construction procedures.

1865. Biaxially Loaded Reinforced Concrete Columns, by Kuang-Han Chu and Algis Pabarcius. (ST) A numerical procedure is developed to determine the actual stress and strain distribution of a tentatively selected reinforced concrete section subjected to a given compressive axial load and bending moments in both directions about principal axes. The investigation is based on the ultimate strength theories of Jensen and Hognestad.

1866. Inspection and Tests of Welding of Highway Bridges, by John L. Beaton. (ST) The inspection techniques developed by the California Division of Highways for the control of the fabrication of welded highway bridges are examined. The use of radiography and other forms of nondestructive testing is outlined with special emphasis on the standards used to interpret the radiographic film.

1867. Direct Design of Optimum Indeterminate Trusses, by Louis M. Laushey. (ST) A direct design method is proposed for indeterminate trusses. The maximum possible compatible stresses are obtained for the bars. Redundant reactions and bar forces are selected to yield the minimum weight truss. Final bar areas then follow directly. Simultaneous equations and trial analyses are avoided. Design is emphasized, not analysis.

1868. Six Thousand High School Students View Engineering and Scientific Careers: Report of the Student Activities Committee, San Diego Section, ASCE. (PP) Our national professional engineering societies have expressed concern over the engineering student shortage in our country. As a means of investigating the reasons for this shortage, a questionnaire was prepared. This paper presents the results of these questionnaires.

1869. Engineering Education as it Affects Unity in the Profession, by Frederick G. Lindvall. (PP) The present departmental educational pattern tends to exaggerate differences among fields of engineering and obscure for the student the common objectives and substance of engineering. Technological trends and the basic character of the appropriate education is examined.

1870. Pity the Poor Professors?—or Propagate Them!, by Jack McKee. (PP) The need for expanded and improved faculties of engineering is examined. Also considered are methods for retaining outstanding young engineers in the academic community, and action that can be taken by ASCE members.

1871. Importance of Emphasis in Civil Engineering Education, by L. E. Grinter. (PP) The tendency of new engineering students to choose electrical or aeronautical over civil engineering is explained by greater emphasis upon fundamentals of science and mathematics in these curricula which prepare their graduates for work on the frontiers of technology. A curriculum is presented for modernizing civil engineering education.

1872. Sputniks, Flopniks, and Engineering Education, by C. Ken Weidner. (PP) If we are to survive as a nation, we must produce creative thinkers, especially in science and engineering. Strong recommendations for achieving this goal are presented.

1873. Vertical-Lift Gate Design for Ice Harbor Lock, by Howard M. Rigler and Edmund H. Chun. (WW) This paper presents design details of the downstream lift gate for the Ice Harbor lock and some of the problems encountered. Also presented are the major features of the lock as a whole.

ORDER FORM FOR PROCEEDINGS

(For ASCE member use only)

To obtain complete Journals or reprints of the papers listed here, complete the mailing label below, write in the Journal name or paper numbers desired, cut it from this section, insert the label in an envelope, and mail to ASCE, 33 West 39th St., N.Y. 18, N.Y. Please make the mailing label legible—correct delivery is up to you.

Name .... Membership Grade..........

Address ....

City .... Zone.......... State.............................

Papers:

Journals (at a cost of $1.50 each):

1874. Columbia Basin Streamflow Routing by Computer, by David M. Rockwood. (WW) A method for using a digital computer for streamflow routing in the Columbia Basin is described. A new routing technique is made possible by use of the computer.

1875. Financing of Sand By-Passing Operations, by Stephen R. Middleton. (WW) This paper presents information on the financing of twelve sand by-passing operations. Possible trends in the financing of work of this kind is considered and information is given on the problems and procedures in financing sand by-passing projects at various governmental levels.

1876. Motion of Sand Between Groins, by Shoshichiro Nagai and Hirokazu Kubo. (WW) Experiments on the motion of sand particles between groins were performed in a fixed basin to compare with the results of groins in a movable bed. The comparison proved that both results were in comparatively good agreement.

1877. City Planning Education for the Civil Engineer; Progress Report of the Committee on Education of the City Planning Division. (CP) The role of the city planner is essential in this era of expanding urbanization in which the problems of city planning and the need for trained city planners is receiving increased attention. Good opportunities for employment exist for those with training in principles and practice of city planning.

1878. Review of Limit Design for Concrete, by C. W. Yu and Eivind Hognestad. (ST) The development of limit design of reinforced concrete structures and various theoretical approaches are reviewed. Codes of practice of countries recommending limit design are quoted. The importance of incorporating limit design into future United States practice is stressed, and approaches toward this aim are suggested.

1879. Elasti-Plastic Analysis of Continuous Frames and Beams, by Lawrence P. Johnson, Jr., and Herbert A. Sawyer, Jr. (ST) An analytical solution considering both elastic and plastic flexural deformations is presented for continuous beams and frames. The method has limitations characteristic of limit design methods except that it determines strength as defined by the moment-curvature relationship as well as an ultimate moment, and allows ready determination of deflections.

1880. Discussion of Proceedings Paper 1197, 1662. (HY) J. Bogardi corrections to 1197. Howard M. Turner on 1662.

1881. Discussion of Proceedings Paper 1645, 1648, 1649, 1654, 1655. (SM) R. G. Ahlvin, D. Hugh Trollope on 1645. A. A. Eremin on 1648. A. A. Eremin on 1649. D. P. Krynine, Dean R. Freitag on 1654. J. MacNeil Turnbull on 1655.

1882. Discussion of Proceedings Paper 1638, 1708, 1709, 1710, 1712, (ST) B. R. Cooke on 1638. Arthur N. Gilbert on 1708. Arthur N. Gilbert on 1709. Arthur N. Gilbert on 1710. Arthur N. Gilbert, Louis Balog on 1712.

1883. Discussion of Proceedings Paper 1486. (PP) K. E. McKee on 1486.

1884. Discussion of Proceedings Paper 1514, 1568, 1571. (WW) Louis H. Foote closure to 1514. C. L. Bretschneider corrections to 1568. J. E. Chappelear on 1568. Basil W. Wilson on 1571.

1885. Discussion of Proceedings Paper 1620. (CP) Nathan Cherniack, William H. Claire, Joseph Horowitz on 1620. Sergei N. Grimm Closure to 1620.

1886. Las Morochas Gas Turbine Power Plant, by A. J. Michael. (PO) This paper presents civil engineering aspects of gas turbine power plants which are different from the more conventional type of thermal power plant.

1887. Civil Engineering Features of TVA Steam Electric Stations, by George P. Palo, Walter F. Emmons, and Nathan E. Way. (PO) Since 1949 the TVA has built seven large steam electric stations. This paper presents features which are of interest in the design of steam plants.

1888. Ocean Cooling Water System for 800 MW Power Station, by Robert H. Weight. (PO) The use of ocean water for cooling must provide for corrosion effects and control of fish and marine growth. This paper describes model studies assuring economical control and handling of water quantities used, with consideration to earthquake and subsidence.

1889. Water Supply to Thermal Power Plants, by E. J. Stankiewicz. (PO) This paper examines water quantities required, sources, circulating water systems and uses, and reviews the water supply systems for several power stations.

1890. Experiments on Self-Aerated Flow in Open Channels, by Lorenz G. Straub and Alvin G. Anderson. (HY) Measurements of air-concentration distribution in high velocity open-channel flows indicate that air content can be related to the flow characteristics and can be described by turbulence concepts.

1891. Abstracts and Index to Proceedings, Volume 84 (1958), by the Board of Direction. (BD) A list of abstracts and a subject and author index have been prepared for all Proceedings Papers published in 1958; the numbers covered are 1494 to 1890. The subject headings used were taken from the names of the technical divisions of the Society; other headings were added when deemed necessary. By use of the author index, it is possible to trace all the discussion that a paper has received.

INSTRUCTIONS

1. Every ASCE member can be registered in two of the Technical Divisions and receive automatically all papers sponsored by those Divisions. **Such registration will be effective 30 days after the receipt of the registration form.**

2. In addition to those papers sponsored by the Divisions in which he is registered, a member is entitled to 100 different papers during a fiscal year beginning October 1.

3. Members' accounts will be charged 25¢ each for additional duplicate copies of a paper and for papers in excess of his free allotment.

4. Papers should be ordered by serial number. The member should keep a record of papers ordered to avoid unwanted duplication.

5. Non-members of the Society may order copies of Proceedings papers by letter with remittance of 50¢ per copy; members of Student Chapters, 25¢ per copy.

Standing orders for all Papers in any calendar year may be entered at the following annual rates: Members of ASCE, $15.00; members of Student Chapters, $15.00; non-members, $40.00; libraries, $25.00.

TRANSACTIONS. Specially selected PROCEEDINGS papers with discussions will be included in TRANSACTIONS. Annual volumes of TRANSACTIONS will continue to be available at the current established annual subscription rates.

	To Members	To Non-Members
Morocco-grained binding	$4.00	$18.00
Cloth binding	3.00	17.00
Paper binding	2.00	16.00

KEY TO TECHNICAL DIVISION SPONSORSHIP

(AT)	Air Transport
(CP)	City Planning
(CO)	Construction
(EM)	Engineering Mechanics
(HW)	Highway
(HY)	Hydraulics
(IR)	Irrigation and Drainage
(PL)	Pipeline
(PO)	Power
(SA)	Sanitary Engineering
(SM)	Soil Mechanics and Foundations
(ST)	Structural
(SU)	Surveying and Mapping
(WW)	Waterways and Harbors
(PP)	Professional Practice

PROFESSIONAL SERVICES

Listed alphabetically by areas, states, cities and names

EASTERN

More and More Members of the Society are using this Service.
Is Your Card Here?

DIVISION ENROLLMENT FORM

American Society of Civil Engineers
33 West 39th Street, New York 18, New York

☐ I am already enrolled
or
☐ I wish to be enrolled
in the ....
Division and receive automatically the Journal of that Division.

In addition, I wish to be enrolled in the
....
Division and receive automatically the Journal of that Division.

(Signature)

(Please print name) (Membership grade)

PLEASE PRINT MAILING ADDRESS ONLY

(Number and Street)

(City) (Zone) State

PROFESSIONAL SERVICES

Listed alphabetically by areas, states, cities and names

Just Off The Press

TRANSACTIONS

Vol. 123 (1958)

By clipping this coupon and remitting as indicated below, the latest engineering milestone can be added to your technical library.

Binding	*Members*	*Non-members*
Paper	$2.00	$16.00
Cloth	3.00	17.00
Morocco grained	4.00	18.00

Special discount to libraries and members of student chapters

---

American Society of Civil Engineers
33 West 39th St., New York 18, N.Y.

Please send Vol. 123 in.................binding

(I am)........(I am not)........a member of ASCE.

The amount enclosed is $........................

Name ....

Address ....

City ....Zone......State........

☐ Enter my standing order for future Transactions in the binding indicated.

PROFESSIONAL SERVICES

Listed alphabetically by areas, states, cities and names

CAPITOL ENGINEERING CORPORATION
Consulting Engineers
Design and Surveys • Roads and Streets
Sewer Systems • Water Works
Planning • Airports
Bridges • Turnpikes • Dams
Executive Offices
Dillsburg, Pennsylvania
Washington, D. C. **Pittsburgh, Pa.**
Rochester, N. Y. **Saigon, Vietnam**

GANNETT FLEMING CORDDRY & CARPENTER, INC.
Engineers
Dams, Water Works, Sewage, Industrial Waste and Garbage Disposal • Highways Bridges and Airports, Traffic and Parking • Appraisals, Investigations, and Reports
HARRISBURG, PENNA.
Pittsburgh, Pa. **Philadelphia, Pa.**
Daytona Beach, Fla.

MODJESKI AND MASTERS
Consulting Engineers
F. M. Masters
G. H. Randall **J. R. Giese**
C. W. Hanson **H. J. Engel**
Design and Supervision of Construction
Inspection and Reports
Bridges, Structures and Foundations
P.O. Box 167 **Philadelphia, Pa.**
Harrisburg, Pa. **New Orleans, La.**

AERO SERVICE CORPORATION
Integrated surveying and mapping services—including soils and sub-surface studies—for Highways, Water Supply, Dams, Airports, Municipal Developments, and other large engineering projects. Also associated electronic computing services.
210 E. Courtland St., Philadelphia 20, Pa.

ALBRIGHT & FRIEL INC.
CONSULTING ENGINEERS
Water, Sewage, Industrial Wastes and Incineration Problems, City Planning, Highways, Bridges and Airports, Dams, Flood Control, Industrial Buildings, Investigations, Reports, Appraisals and Rates
Three Penn Center Plaza
Philadelphia 2, Pa.

LAWRENCE T. BECK AND ASSOCIATES
Engineers and Consultants
Philadelphia **New York** **Washington**

JUSTIN & COURTNEY
Consulting Engineers
Joel B. Justin **Neville C. Courtney**
Dams and Power Problems
Hydro Electric Developments
Foundations
121 S. Broad St. **Philadelphia 7, Pa.**

H. A. KULJIAN & COMPANY
Engineers and Architects
Power Plants (steam, hydro, diesel)
Industrial Buildings • Army & Navy Installations • Airports, Hangars
Water and Sewage Works
Design • Investigations • Reports • Surveys
1200 No. Broad St. **Phila. 21, Pa.**

HUNTING, LARSEN & DUNNELLS
Engineers
Industrial Plants • Warehouses
Commercial Buildings • Office Buildings
Laboratories • Steel and Reinforced
Concrete Design • Supervision
Reports
1150 Century Bldg., Pittsburgh 22, Pa.

MORRIS KNOWLES INC.
Engineers
Water Supply and Purification
Sewerage and Sewage Disposal
Valuations, Laboratory, City
Planning
1312 Park Bldg., **Pittsburgh 22, Pa.**

PENNSYLVANIA DRILLING COMPANY
Subsurface Explorations. Grouting
Industrial Water Supply. Mineral Prospecting
Large Diameter Drilled Shafts
Reports
1205 Chartiers Ave. **Pittsburgh 20, Pa.**

GILBERT ASSOCIATES, INC.
Engineers and Consultants
Surveys • Design • Supervision
Sanitary Engineering
Industrials and Utilities
Domestic and Foreign
525 Lancaster Avenue, Reading, Pa.
New York • Washington

MICHAEL BAKER, JR., INC.
The Baker Engineers
Civil Engineers, Planners, and Surveyors
Airports, Highways, Sewage Disposal Systems, Water Works Design and Operation, City Planning, Municipal Engineering, All Types of Surveys
Home Office: Rochester, Pa.
Branch Office
Jackson, Miss. **Harrisburg, Pa.**

SPRAGUE & HENWOOD, INC.
Foundation Investigations • Soil Testing and Test Borings • Grout Hole Drilling and Pressure Grouting • Diamond Core Drilling
Scranton, Pa. **New York, N. Y.**
Philadelphia, Pa. **Grand Junction, Colo.**
Pittsburgh, Pa. **Atlanta, Georgia**
Buchans, Newfoundland

BUCHART ENGINEERING CORP.
Consulting Engineers
Highways—Bridges—Sewer Systems—Surveys—Water Works—Dams—Reports—Supervision—Industrial—Municipal—Structures
55 S. Richland Ave., York, Pa.
Lancaster, Pa. **Washington, D. C.**

C. W. RIVA CO.
Edgar P. Snow **John F. Westman**
Highways, Bridges, Tunnels, Airports, Sewerage, Water Supply, Soil Tests, Reports, Design and Supervision
Great Neck, N. Y. **Prov. 3, R. I.**
No. Attleboro, Mass.

MID-WESTERN

ALVORD BURDICK & HOWSON
Consulting Engineers
Water Works, Sewerage, Water Purification, Sewage Treatment, Flood Relief, Power Generation, Drainage, Appraisals
20 North Wacker Drive, Chicago 6, Ill.

CONSOER, TOWNSEND & ASSOCIATES
Water Supply, Sewerage, Flood Control and Drainage, Bridges, Express Highways, Paving, Power Plants, Appraisals, Reports, Traffic Studies, Airports, Gas and Electric Transmission Lines
360 E. Grand Ave., Chicago 11, Illinois
9½ Indiana St., Greencastle, Ind.

GREELEY AND HANSEN
Water Supply, Water Purification, Sewerage, Sewage Treatment, Refuse Disposal, Industrial Wastes
220 S. State Street, Chicago 4, Illinois

DeLEUW, CATHER & COMPANY
Consulting Engineers
Public Transit — Subways
Traffic & Parking — Railroad Facilities
Expressways — Industrial Plants
Grade Separations — Municipal Works
Urban Renewal — Port Development
150 North Wacker Drive, Chicago 6
San Francisco **Toronto** **Oklahoma City**

HARZA ENGINEERING COMPANY
Consulting Engineers
Calvin V. Davis **E. Montford Fucik**
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development
400 West Madison Street **Chicago 6**

C. MARTIN RIEDEL
Consulting Engineer
Chemical Soil Solidification Engineering
for
Tunnels, Shafts, Mines, Foundations
Underground Structures
7650 S. Laflin St. **Chicago 20, Illinois**
29-27 41st Ave., Long Island City 1, N.Y.

SOIL TESTING SERVICES, INC.
Consulting Engineers
John P. Gnaedinger — Carl A. Metz
Sub-Surface Investigations, Laboratory testing, Inspection, Engineering Reports And Design of Foundations
1827 No. Harlem Ave., Chicago 35, Ill
Kenilworth, N. J.—San Francisco, Calif.
Vedado Hana, Cuba

STANLEY ENGINEERING COMPANY
Consulting Engineers
208 S. LaSalle Street **Hershey Building**
Chicago 4, Illinois **Muscatine, Iowa**

JENKINS, MERCHANT & NANKIVIL
Consulting Engineers
Municipal Improvements — Sewerage
Power Development — Water Systems
Traffic Surveys — Industrial Plants
Flood Control — Recreational Facilities
Airports — Investigations and Reports
805 East Miller Street
Springfield, Illinois

CLARK, DAILY & DIETZ
Consulting Engineers
James G. Clark — Jess C. Dietz
Eugene J. Daily — W. Don Painter
Expressways • Structures • Sanitary • Civil
211 N. Race, Urbana, Illinois
188 Jefferson, Memphis, Tennessee

NED L. ASHTON
Consulting Engineer
Aluminum and Steel Structures
Bridges and Paraboloidal Antennas
Swimming Pools and Foundations
Welded Design and Strengthening
820 Park Road **Iowa City, Iowa**

BLACK & VEATCH
Consulting Engineers
Water, Sewage, Electricity, Industry, Reports, Design Supervision of Construction Investigations, Valuation and Rates
1500 Meadow Lake Parkway
Kansas City 14, Missouri

BURNS & McDONNELL
Engineers • Architects • Consultants
Kansas City, Missouri • P.O. Box 7088
Phone: DElmar 3-4375

HOWARD, NEEDLES, TAMMEN & BERGENDOFF
Consulting Engineers
Bridges, Structures, Foundations
Express Highways
Administrative Services
1805 Grand Avenue **99 Church Street**
Kansas City 6, Mo. **New York 7, N. Y.**

SVERDRUP & PARCEL, INC.
Engineers • Architects
Bridges, Structures and Reports
Industrial and Power Plant
Engineering
915 Olive Street, St. Louis 1, Mo.
417 Montgomery Street,
San Francisco 4, Cal.

A. L. ALIN
Consulting Engineer
5927 N. 24 Street
Omaha 10, Nebraska
Dams, Hydroelectric Power
Flood Control

HAZELET & ERDAL
Consulting Engineers
Design, Supervision, Investigations, Reports
Fixed Bridges — Movable Bridges
Expressway Systems — Harbor Works & Dams
Dixie Terminal Bldg., Cincinnati 2, O.
Monadnock Block, Chicago 4, Ill.
Oding Bldg., Lansing 33, Mich.
Commerce Bldg., Louisville 2, Ky.

Additional Professional Cards on Pages 126, 127 and 129

PROFESSIONAL SERVICES

Listed alphabetically by areas, states, cities and names

VOGT, IVERS, SEAMAN & ASSOC.
Engineers-Architects
Highways — Structures — Expressways
Industrial Bldgs. — Harbor Facilities
Airports — Dams — Docks
Surveys — Reports
34 W. Sixth St., Cincinnati 2, O.
20 N. Wacker Dr., Chicago 6, Ill.

THE AUSTIN COMPANY
Design • Construction • Reports • Plant Location Surveys • Domestic and Foreign Work
16112 Euclid Avenue, Cleveland, Ohio
New York Detroit Oakland
Chicago Houston Seattle
Los Angeles

HAVENS AND EMERSON
A. A. Burger
Harry H. Moseley J. W. Avery
Frank S. Palocsay Edward S. Ordway
Frank C. Tolles, Consultant
Consulting Engineers
Water, Sewerage, Garbage, Industrial Wastes, Valuation, Laboratories
Leader Bldg. Woolworth Bldg.
Cleveland 14, O. New York 7, N. Y.

THE OSBORN ENGINEERING COMPANY
Designing • Consulting
Industrial Plants Office Buildings
Stadiums Grand Stands Field Houses
Bridges Garages Laboratories
7016 Euclid Ave. Cleveland 3, Ohio

BENHAM ENGINEERING COMPANY
and Affiliates
Surveys Design & Supervision
of
Civil Mechanical Electrical
Sanitary Structural
Engineering Projects
and
All Types of Building Construction
215 N.E. 23rd St., Okla. City 5, Okla.

ALFRED H. GRUPPE
Consulting Engineer
Design and Construction Supervision of Bridges, Buildings, Foundations, Concrete and Steel Structures
828 N. Broadway
Milwaukee 2, Wisconsin

SOUTHERN

PALMER & BAKER, ENGINEERS, INC.
Consulting Engineers and Architects
Tunnels, Bridges, Highways, Airports, Industrial Buildings, Harbor Structures, Soils, Materials and Chemical Laboratories
Mobile, Ala. New Orleans, La.
Washington, D. C.

JAMES M. DANIEL — JAMES J. LEWIS AND ASSOCIATES
Civil and Mining Engineering Consultants
United States and Foreign
860 Porter Place • Lexington, Ky.

EUSTIS ENGINEERING COMPANY
Foundation and Soil Mechanics Investigations
Soil Borings Laboratory Tests
Foundation Analyses Reports
3635 Airline Highway
Metairie, Louisiana

BEDELL & NELSON ENGINEERS, INC.
Consulting Engineers — Architects
Airports, Buildings & Industrial Structures, City & Site Planning, Harbor Structures, Highways & Bridges, Industrial Plants, Municipal Improvements & Utilities, Reports, Estimates, Design, Supervision
1200 St. Charles Ave., New Orleans, La.

FROMHERZ ENGINEERS
Structural • Civil • Sanitary
Four Generations Since 1867
Water Supply, Sewerage, Structures, Drainage, Foundations, Industrial Waste Disposal, Investigations, Reports, Plans and Specifications, Supervision
816 Howard Avenue, New Orleans

WILLIAM F. GUYTON AND ASSOCIATES
Consulting Ground-Water Hydrologists
Underground Water Supplies
Investigations, Reports, Advice
307 W. 12th St., Austin 1, Texas
Phone: GR 7-7165

SPENCER J. BUCHANAN AND ASSOCIATES, INC.
Consulting Engineers
Soil Mechanics and Foundation Engineering, Earth Dams, Wharves, Airfields, Highways, Drainage, Structural Foundations; Reports, Design, and Field Supervision
310 Varisco Building, Bryan, Texas
Phone TAylor 2-3767

SOIL MECHANICS INCORPORATED
Foundation Exploration and Testing Services
Site Investigations, Soil Borings, Field and Laboratory Testing, Load Tests, Reports
310 Varisco Building, Bryan, Texas
Phone TAylor 2-3767
Houston — Phone MOhawk 7-1869

LOCKWOOD, ANDREWS & NEWNAM
Consulting Engineers
Industrial Plants, Harbors, Public Works Roads, Airport, Structures, Earthworks Mechanical and Electrical
Reports • Design • Supervision
Surveys • Valuations
Corpus Christi • HOUSTON • Victoria Texas

ENGINEERS TESTING LABORATORY, INC.
Soil Mechanics and Foundation Engineering
Soil Borings Laboratory Tests
Foundation Analyses Reports
2116 Canada Dry St., Houston 23, Texas
444 North 9th Street, Baton Rouge, La.

McCLELLAND ENGINEERS
Soil and Foundation Consultants
Investigation • Reports
Supervision • Borings and Tests
2649 N. Main St. Houston 9, Texas

PRESTRESSING RESEARCH & DEVELOPMENT, INC.
Prestressed Concrete Design
Bridges Buildings Waterfront Structures
Arches, Shells Domes
1511 Transit Tower, San Antonio, Texas

WESTERN

JOHN S. COTTON
Consulting Engineer
Hydroelectric, irrigation, water supply, and multiple purpose projects, flood and erosion control, river basin development planning, dams and their foundations, tunnels, marine structures, valuations, rates.
24 Evergreen Drive, Kentfield, Calif.

DAMES & MOORE
Soil Mechanics Engineering
Los Angeles • San Francisco • Portland
Seattle • Salt Lake City • Chicago
New York • Atlanta • London
General Offices, 816 West Fifth Street
Los Angeles 17, Calif.

HOLMES & NARVER, INC.
Engineers • Constructors
Industrial, Petroleum and Chemical,
Nuclear, Missile Facilities
828 S. Figueroa Street
Los Angeles 17, California

C. E. JACOB
Groundwater Consultant
Water Supply, Drainage, Dewatering, Subsidence, Recharging, Salt-Water Control, Statistical Hydrology, Digital and Analog Computation
P.O. Box 347 Northridge, Calif.
Cable JACOBWELL Los Angeles
Dickens 5-4990

KAISER ENGINEERS
Division of Henry J. Kaiser Company
ENGINEER • CONTRACTOR
Investigation • Reports • Valuations
Design • Construction
Crestview 1-2211
1924 Broadway Oakland, Calif.

WOODWARD, CLYDE, SHERARD AND ASSOCIATES
Soil and Foundation Engineering; Earth Dams; Engineering Geology; Highway and Airport Pavement Design
1150 28th Street Oakland, California
1240 W. Bayaud St., Denver, Colo.
Suite 310, V.F.W. Bldg., Kansas City, Mo.
4815 Dodge Street, Omaha, Nebraska

INTERNATIONAL ENGINEERING COMPANY INC.
Engineers
Investigations • Reports • Design
Procurement • Field Engineering
Domestic and Foreign
74 New Montgomery St.
San Francisco 5, California

JACOBS ASSOCIATES
Consulting Construction Engineers
Appraisal of Construction Costs • Methods Analysis • Field Engineering • Job Management • Review of Bidding Documents for Construction Economy • Engineering Geology • Plant and Equipment Design
503 Market Street
San Francisco 5, California

FOREIGN

SAENZ-CANCIO-MARTIN
Ingenieros
ALVAREZ y GUTIERREZ
Arquitectos
Consulting Engineers and Architects
Ave. de la Independencia 774
Ensanche del Vedado, Habana, Cuba

DUMONT-GREER ASSOCIATES
Architects-Engineers
Airports, Port Facilities
Public Works Projects,
Industrial, Urban, Agricultural and Rural Development
Design and Construction Supervision
1 Rue du Rhone Geneva, Switzerland
TELEPHONE: 24.63.87

AMMANN & WHITNEY
CONSULTING ENGINEERS
111 Eighth Avenue, New York 11, N. Y.
Buildings, Industrial Plants, Airport Facilities
Bridges, Highways, Special Structures
29 Rue des Pyramides, Paris, France
32 Patission Street, Athens, Greece
P.O. Box 1423, Tehran, Iran
P.O. Box 1498, Addis Ababa, Ethiopia

USE THIS PROFESSIONAL CARD DIRECTORY

Participation is restricted to members or firms where one or more of the principals are members of the American Society of Civil Engineers

Your Card Should Be Among Them • Write Today for Rates

Index To Advertisers

Advertising Manager

James T. Norton

Advertising Production Manager

Alice M. Doerle

33 West 39th Street, New York 18, N. Y.

Representatives

EASTERN

ROBERT S. CYPHER
• 33 West 39th Street, New York 18, N. Y.

SOUTHEASTERN

• FRED W. SMITH
1201 Forest View Lane—Vesthaven
Birmingham 9, Ala.

MID-WESTERN

• RICHARD K. HOLMSTROM
84 East Randolph St., Chicago 1, Ill.

WESTERN

• McDONALD-THOMPSON COMPANY
625 Market St., San Francisco 5, Calif.
3727 West Sixth St., Los Angeles 5, Calif.
National Bldg., 1008 Western Ave., Seattle 4, Wash.
404 Times Bldg., Portland 4, Ore.
3217 Montrose Boulevard, Houston 6, Texas
Colorado National Bank Bldg., Denver 2, Colo.
2010 So. Utica St., Tulsa 4, Okla.

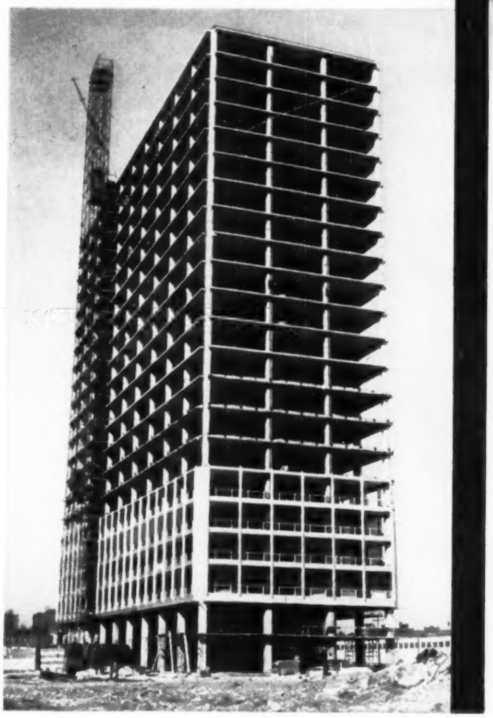
as in Detroit Today . . .

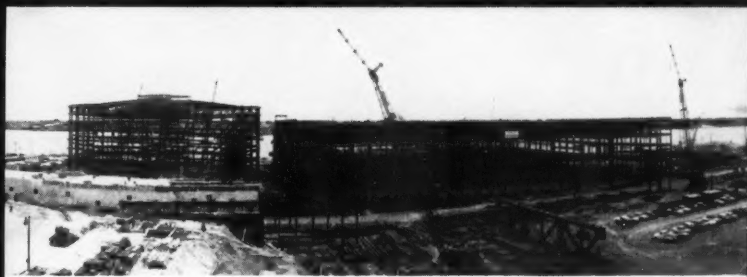
NATIONAL BANK BUILDING
Arch. — Albert Kahn Assocs., Detroit; G. C. Superstructure—Bryant & Detwiler Co., Detroit; G. C. Sub-structure—Case Foundation Co., Roselle, Ill.; POZZOLITH Concrete — Cronin Transit Mix Co., Detroit; Precast POZZOLITH Lightweight Concrete Panels — Adams Concrete Products Co., Ypsilanti, Mich.

GREYHOUND BUS TERMINAL
Arch. — Arrasmith & Tyler Assocs., Louisville, Ky., Assoc.—Clair W. Ditchy, Royal Oak, Mich.; Struct. Eng. — Ray Covey, Detroit; G. C. — Bryant & Detwiler Co., Detroit; POZZOLITH Concrete — Cronin Transit Mix Co., Detroit.

INTERNATIONAL BUSINESS MACHINE CORPORATION
Arch. — Pedersen & Tilney, N.Y.C., Assoc. — Swanson & Assocs., Bloomfield Hills, Mich.; Struct. Eng. — Edwards & Hjorth, N.Y.C.; G. C.—R. E. Dailey & Co., Detroit; POZZOLITH Lightweight Concrete — Koenig Coal & Supply Co., Detroit.

LAFAYETTE PARK BUILDING
Owner—Herbert Realty Co., Inc., Chicago; Arch.—Mies Van Der Rohe, Chicago; Struct. Eng.—Frank Kornacker, Chicago, G. C. — Herbert Construction Co., Chicago; POZZOLITH Concrete—Cronin Transit Mix Co., Detroit.





CONVENTION HALL AND COBO EXHIBIT BUILDING
Owner—City of Detroit; Arch. & Eng.—Giffels & Vallet Inc., Assoc.—L. Rossetti; G. C.—O. W. Burke Co.; POZZOLITH Lightweight Concrete—Sugden & Sivier, Inc.—all of Detroit.

Where there's progress there's POZZOLITH *Concrete*

The designers and builders of these fine structures employed POZZOLITH* to obtain concrete of superior quality most economically.

For many years in Detroit and throughout the country, where careful attention is given to concrete performance and costs, the use of POZZOLITH has been steadily increasing.

You will also benefit by using POZZOLITH, because on *your* job, with *your* materials, neither plain concrete nor concrete with any other admixture can match the results obtained with POZZOLITH.

* POZZOLITH—registered trademark of The Master Builders Company for its concrete admixture that reduces water, controls air entrainment and controls the rate of hardening.

THE MASTER BUILDERS CO.
DIVISION OF AMERICAN-MARIETTA CO.

General Offices: Cleveland 3, Ohio • Toronto 9, Ontario • *Export:* New York 17, N. Y.
Branch Offices In All Principal Cities • *Cable: Mastmethod, N. Y.*


When the
log jam breaks...